

**RA. 1217**

**H.F. COMMUNICATIONS RECEIVER**

**VOLUME I**

**OPERATORS MANUAL**

**RACAL**

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# RA. 1217 MAINTENANCE MANUAL

## PREFACE

### Handbook Guide

This Volume contains detailed information for maintenance purposes. It is assumed that the user also has a copy of the RA.1217 Operators Manual, to which reference should be made for general information concerning installation, operation, and technical principles.

### Variants

Chapters 1 to 8 of this Volume refer to the basic RA. 1217 receiver. Details of any variant models will be given in appendices, which will be inserted immediately prior to the illustrations at the rear of the handbook.

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## CHAPTER 1

### GENERAL DESCRIPTION

#### INTRODUCTION

1. The RA.1217 is a versatile high-stability h.f. communications receiver designed for use in a 19-inch (48.25 c.m.) rack mounting under all climatic conditions. Solid state techniques are used throughout. The frequency range is 1 to 30 MHz. Operation down to 200 kHz (but with slightly degraded performance) can be obtained by linking terminals on the rear panel. A comprehensive range of ancillary units can be connected to the receiver.

#### TECHNICAL INFORMATION

2. This handbook contains installation and operating information with a brief technical description. The circuits at the rear of the book are for information only. For detailed technical descriptions, alignment instructions and component details, the user must refer to the RA.1217 Maintenance Manual.

#### RA.1217 VARIANTS

3. Specification variation is normally confined to a choice of i.f. filter bandwidths and optional audio outputs of either 10 mW 600 $\Omega$  or one-watt 15 $\Omega$ . The first production receivers are fitted with the one-watt amplifier but the standard receiver is now the 10 mW type. It should be noted that the one-watt version cannot provide d.c. power for ancillary units such as an i.s.b. adaptor, f.s.k. converter etc. Refer to the Preface which precedes this page for guidance in the identification of the different types of audio amplifier.

#### ANCILLARY EQUIPMENT

4. The RA.1217 is provided with a number of outlets which permit the attachment of additional units such as :-



**RA.1217 TRANSISTORISED H.F. COMMUNICATIONS RECEIVER**

- (a) A frequency synthesizer or pre-set channel oscillator which can provide very precise and stable frequency setting of the receiver.
- (b) Panoramic adaptor to provide visual display of a portion of the frequency spectrum.
- (c) L. F. Adaptor which extends the lower frequency limit of the receiver to 3 kHz.
- (d) Diversity switching unit for linking two RA.1217 receivers in dual diversity reception.
- (e) Line amplifier, signal frequency measuring equipment, i.s.b. adaptor etc.

## GENERAL INFORMATION

### Tuning

5. The receiver is tuned by two principal controls, one control is set to indicate the 'megahertz' content of the signal frequency, the other is set to indicate the 'kilohertz' content. The frequency indication is by a mechanical in-line readout system providing a digital display. Scale markings enable the frequency to be set to an accuracy of 0.2 kHz.
6. The RA.1217 can be tuned over its entire frequency range with no mechanical band-switching. The r.f. input can be set to 'wideband' or tuned circuits can be switched into the r.f. input stage to obtain improved rejection of adjacent channels. An r.f. attenuator control permits selected attenuation of the input signals to minimize the effects of severe interference or excessive signal strength.
7. The Megahertz (MHZ) and Kilohertz (KHZ) tuning controls can be mechanically locked to their selected positions. A calibrate and fine tune control provides a range of tuning adjustment of 8 kHz, this is useful as a clarifier in single sideband reception or as a fine adjustment when the main controls are locked. Calibration signals at 100 kHz intervals, derived from the internal reference crystal oscillator are available for aligning the kilohertz tuning readout.

### Audio Outputs

8. The standard receiver provides the following outputs:
- (a) 10 mW 600 $\Omega$  at the Phones socket on the front panel.
  - (b) 1 mW 600 $\Omega$  (balanced) at the rear outlet.
  - (c) 10 mW 600 $\Omega$  (unbalanced) at the rear outlet.

Earlier receivers are fitted with a one-watt audio amplifier. Refer to the Preface at the beginning of this chapter.

### Construction

9. The receiver is of modular construction, each module being a separate unit connected by plugs and sockets. The main chassis is of cast aluminium to which the individual modules are attached. A range of alternative sub-assemblies is available, providing for the choice of either 100 kHz or 455 kHz output, and for the provision of non-standard bandwidths to meet special requirements.

### Individual Modules and Assemblies

- |     |     |   |     |                                 |
|-----|-----|---|-----|---------------------------------|
| 10. | (a) | Main Chassis                                    | (g) | 37.5 MHz B.P. Filter            |
|     | (b) | R. F. Unit                                      | (h) | 3rd Mixer                       |
|     | (c) | 1st V. F. O.                                    | (i) | 2nd V. F. O.                    |
|     | (d) | 1st Mixer and 40 MHz Filter                     | (j) | First I. F. Amplifier Unit      |
|     | (e) | 2nd Mixer                                       | (k) | Main I. F. Module               |
|     | (f) | 37.5 MHz Generator<br>1 MHz Osc. and calibrator | (l) | B. F. O. and Bandwidth Assembly |
|     |     |   | (m) | Power Unit                      |
|     |     |   | (n) | Audio Amplifier Board           |

### Power Supply

11. The standard power unit is the PU. 1153 which can operate from the following power sources:
- (a) A. C. 100 - 125 or 200 - 250V 45 - 400 Hz Single phase
  - (b) D. C. 21 - 27 V, positive earth.

An alternative power unit is available, to operate from d. c. only in the supply



range 9 to 30 V with either positive or negative earth. The 10 mW receiver power consumption is 10 VA approximately. The attachment of ancillary units will increase the power consumption by a further 10 VA approximately. If a one-watt audio amplifier board is fitted, the - 16V h.t. load is increased by approximately 200 milliamps.

#### Optional I. F. Outputs

12. Two types of i. f. unit are available. One provides an i. f. output of 100 kHz, the other of 455 kHz. The customer can check that the correct type is fitted to the receiver by noting the engraving on the i. f. outlet panel which is located at the lower left hand corner when viewing the rear of the receiver. The lower right hand socket is engraved with i. f. output frequency, either 100 kHz OUT, or 455 kHz OUT. Unless otherwise requested, the 100 kHz i. f. unit will be supplied.

#### HANDBOOK NOTES

##### Circuit References

13. Receiver construction is based upon a number of sub-assemblies. Each sub-circuit is separately manufactured and has an individual sequence of component numbering. When studying a technical description or component list, note whether the circuit consists of more than one assembly and ensure that the correct portion of the circuit is referred to. In the R. F. unit it has been considered necessary to allocate a special prefix figure to each sub-circuit in the circuit diagram, but in the other modules it is considered that there should be no difficulty in correct identification of a component.

##### Control References

14. The controls are engraved on the front panel in lower case lettering, but in the handbook such markings will frequently be printed in capital letters (e. g. R. F. TUNE) to add clarity and emphasis to an instruction.

##### Modifications

15. Before studying this Manual refer to the Handbook Change Information sheet at the beginning of the book and note whether any amendments have been introduced since the book was printed.

## CHAPTER 2

### INSTALLATION

#### INTRODUCTION

1. The chapter contains information under three principal headings. "General Information" gives information on the various receiver outlets and connections ; "Preparation for use" describes the essential checks prior to operating the receiver for the first time, and "Connections to Ancillary Units" gives instructions for connecting a Synthesizer, L. F. Adaptor and I. S. B. Adaptor. All connections are made at the rear of the receiver.

#### GENERAL INFORMATION

#### REMOVAL OF COVERS

##### Dust Covers

2. To obtain access to the various modules and chassis components it is necessary to remove the following covers.
  - (a) The top cover.
  - (b) Left-hand side cover (viewed from the front) for access to the R. F. Module.
  - (c) Right-hand side cover for access to the I. F. Module.
  - (d) A small cover on the underside for access to the Audio Amplifier Board.

All covers are secured by screws which are self evident.

##### Module Covers

3. CAUTION: The various module covers are retained by screws which must be tightened securely to maintain a high standard of screening, but when tightening do not apply excessive force which could cause the screw-hole threads to become damaged.

## REAR PANEL CONNECTIONS

4. A brief description is given of each rear panel connection to assist the user in making connections for a particular system or to ancillary units such as i.s.b. adaptor etc. A rear view of the receiver is shown in Fig. 19.

### R. F. Input (Antenna)

5. The antenna should be connected using a coaxial connector and 75Ω unbalanced transmission line to the socket marked R. F. Input.

### 12-way Socket SKT11

NOTE: The free plug and the accessory set for connection to external wiring are :

Plug : Plessey MK4 2CZ83302/5

Accessory Set : 508/1/03013/205

- | 6. | <u>Pin</u> | <u>Function</u>   |
|----|------------|---|
|    | A)         | 1 m W audio output (balanced)   |
|    | B)         |   |
|    | C          | Screen to pin D.  |
|    | D          | 10 m W 600Ω audio output (unbalanced), alternatively 1 watt 15Ω. Refer to Preface at beginning of Chapter 1.  |
|    | E          | -16 volts d. c. power supply output for external use.   |
|    | F          | Unregulated d. c. output at 20 to 24 volts.   |
|    | G          | Antenna muting. An earth loop connected to this terminal operates the muting relay, to protect the receiver input when keying an associated high power transmitter. |
|    | H          | Diversity a. g. c. connection from associated diversity receiver, or a. g. c. from i. s. b. adaptor.  |
|    | J          | Screen to pin H.  |
|    | K          | L. F. H. T. Provides -16V d. c. to L. F. Adaptor Unit.  |
|    | L          | L. F. A. G. C. Provides a. g. c. to L. F. Adaptor Unit.   |
|    | M          | Screen to pin L.  |

## Terminal Block TB1

NOTE: Terminals 1 to 4 on TB1 provide a linking facility to permit receiver operation down to 200 kHz.

7.	<u>Pin No.</u>	<u>Identification</u>	<u>Remarks</u>
	1	H.T. R.F.	For operation down to 200 kHz link pin 1 to pin 2, and and pin 3 to pin 4. Remove the links if an L.F. Adaptor unit is in use. Pins 2 and 4 are in parallel with pins K and L respectively in the 12-way socket SKT11.
	2	H.T. L.F.	
	3	A.G.C. R.F.	
	4	A.G.C. L.F.	
	5	DET	Provides a low-level audio output for driving an external amplifier.

## Coaxial Outlets

8. NOTE 1 : Refer to Table 1 and 2 at the end of this chapter for details of the r.m.s. levels applicable to the following outlets.

NOTE 2: For connecting external wiring to the coaxial sockets SKT1 to 3 and SKT12 to 17 use 75 ohm plug Transradio BNC1/7. (British NATO number 5935-99-580-9636). For a 455 kHz I.F. output at SKT2 use a 50 ohm plug type UG/88U.

<u>Identification</u>	<u>Impedance</u>	<u>Function</u>
SKT1 1.6 MHz	1 k $\Omega$	1.6 MHz I.F. Output
SKT2 100 KHz OUT	75 $\Omega$	100 kHz I.F. Output
or		
SKT2 455 kHz	50 $\Omega$	455 kHz I.F. Output
SKT3 1.7 MHz IN/OUT (100 kHz i.f.)	75 $\Omega$	Accepts 1.7 MHz (or 1.5 MHz) input to 100 kHz i.f. converter Remove the 1.7 MHz crystal when the external 1.7 MHz is in use.
or		
SKT3 1.145 MHz IN/OUT (455 kHz i.f.)	50 $\Omega$	Accepts 1.145 MHz input to 455 kHz i.f. converter, or provides output to slave receiver in diversity.

NOTE: Outlets SKT1 to SKT3 are part of the i.f. module assembly, (Fig. 12).

## REAR PANEL CONNECTIONS (Continued)

<u>Identification</u>	<u>Impedance</u>	<u>Function</u>
SKT12 2nd V.F.O. IN	75Ω	Accepts 3.6 to 4.6 MHz from synthesizer
SKT13 2nd V.F.O. OUT	75Ω	Provides 2nd VFO control of a slave receiver.
SKT14 L.F.	75Ω	Accepts the r.f. signal from an l.f. adaptor.
SKT15 PAN	75Ω	Connects the 2 to 3 MHz i.f. spectrum from the 2nd Mixer to a panoramic adaptor unit.
SKT16 1 MHz IN	75Ω	Accepts an external 1 MHz frequency standard. The internal 1 MHz crystal must be removed when this external source is in use.
SKT17 1 MHz OUT	75Ω	Provides a 1 MHz output from the internal crystal oscillator.

### Earth (Ground) Terminal

9. A terminal is provided on the rear panel for connection to the earthing system of a cabinet.

### Power Module Connections

10. 3-Way Plug PL1
- |       |  |
|-------|--|
| Pin A | A.C. connection to line or D.C. +ve    |
| Pin B | A.C. neutral connection, or D.C. -ve   |
| Pin C | A.C. supply earth (ground) connection. |

The free socket and the accessory set for connecting the external power cable are :

Socket: Plessey 2 CZ 83283/5  
Accessory Set: 508/1/03008/205

## PREPARATION FOR USE

### GENERAL INSPECTION

11.
  - (1) Remove the top cover from the receiver.
  - (2) Check that the receiver assembly is clean and free from damage and that all interconnecting leads and module covers are secure. Note particularly that all gear wheels are clean and free from packing materials and other extraneous matter.
  - (3) Move the lock controls (adjacent to each tuning knob) upward to the "free" position. Check that each tuning control rotates freely over the complete tuning range.
  - (4) Set the 2nd V.F.O. switch to INT.
  - (5) Check that the correct i.f. module is fitted by noting the engravings on the i.f. outlet panel at the rear of the receiver, which will indicate either a 100 kHz, or 455 kHz i.f. output.
  - (6) Check the settings of the A.C./D.C. switch and the Voltage Selector switch on the power module. If necessary, re-set these switches as follows:

#### A.C./D.C. Switch

12. A locking plate displays the required type of power input either 'A.C.' or 'D.C.' If the indication is not correct remove the locking plate (one screw) set the switch in the alternative position and replace the locking plate in the reversed position so that the correct indication is displayed.

#### Voltage Selector Switch

13. This switch is in use when the A.C./D.C. switch is set to A.C. It should display the correct a.c. supply voltage range, either 100-125 or 200-250. If the setting is not correct, remove the locking plate (two screws) re-set the switch and replace the locking plate in the reversed position, so that the correct voltage range is indicated.

#### Fuses

14. Check that the fuses at the rear of the power module are correct in accordance with the rating engraved on the rear panel. The replacement fuse links must be of the anti-surge type. Beswick Type TDC134 is recommended.

## GENERAL INSPECTION (Continued)

### Power Supply Connection

15. A free connector assembly is normally supplied with the receiver for connection to the 3-way plug on the power module. If not supplied, refer to paragraph 10 for details. Connections should be as follows.

16. A. C. Supply

Pin A	Line
Pin B	Neutral
Pin C	Earth (ground)

or

17. D. C. Supply

Pin A	+ve
Pin B	-ve

### Phones

18. Headphones (600 $\Omega$ ) may be plugged into front panel jack socket. The phones jack plug is an Igranic P50.

### Operating Down to 200 kHz

19. (1) On the rear panel link the terminal H.T R.F to the terminal H.T L.F.  
(2) Link the terminal A. G. C. R.F. to the terminal A. G. C. L.F.

### Other Connections

20. Other connections will be according to the users requirements. Refer to paragraphs 6 to 8 under General Information.

## CONNECTIONS TO ANCILLARY UNITS

### SYNTHESIZER CONNECTIONS

#### General

21. The synthesizer, or channel oscillator, should provide the following inputs to the receiver. Inputs (a) and (b) are essential. Input (c) is required only if the external i.f. (100 kHz or 455 kHz) is to be used.

(a) 3.6 to 4.6 MHz (variable). Level to be 100 mV e.m.f. from 75 $\Omega$ .

(b) 1 MHz (fixed). Level to be 100 mV e.m.f. from 75 $\Omega$ .

## CONNECTIONS TO ANCILLARY UNITS (Continued)

- (c) An additional fixed frequency at 1.7 MHz is required for use in receivers equipped for 100 kHz i.f. output, or at 1.145 MHz for receivers with 455 kHz i.f. output. The voltage of the applied frequency must be not less than 50 mV in 75 ohms.

NOTE : The output levels from the Synthesizer Type MA. 350B are 2 volts e.m.f. therefore attenuating connectors must be used with this instrument.

### Connecting the Synthesizer

22.

- (1) Set the 2nd V.F.O. switch on the front panel to EXT
  - (2) Remove the receiver cover
  - (3) Remove the cover from the 37.5 MHz Generator Module
  - (4) Remove the 1 MHz crystal from its holder and store it in a safe place. Replace the module cover.
- NOTE: Operations (5) and (6) are required only if the external i.f. (100 kHz or 455 kHz) is to be used.
- (5) Remove the cover from the i.f. module.
  - (6) Remove the 1.7 MHz (or 1.145 MHz) crystal, and store in a safe place.
  - (7) Replace the cover on the i.f. module.
  - (8) Replace the receiver cover and make the following connections to the rear panel.
  - (9) Connect the 3.6 to 4.6 MHz output from the synthesizer to the socket SKT13 '2nd V.F.O. IN'. Refer to paragraph 21 (a) regarding drive level.
  - (10) Connect the synthesizer 1 MHz output to socket SKT16 '1 MHz IN'. Refer to paragraph 21 (b) regarding drive level.
  - (11) If the receiver is equipped for an i.f. output of 100 kHz, a frequency of 1.7 MHz should be connected to SKT3 (1.7 MHz IN/OUT). If the receiver has an i.f. output of 455 kHz, the 1.145 MHz from the synthesizer should be connected to the same socket which is marked 1.145 MHz IN/OUT.



## L. F. ADAPTOR CONNECTIONS

23. An l.f. adaptor unit such as the RA. 337 must be supplied with -16V d.c. power, a.g.c. and 1 MHz from the receiver. The d.c. connections can be taken from the 12-way connector SKT 11 or from the terminal block TB1, whichever is more convenient.

**CAUTION:** If links have been fitted to the terminal block TB1, for operation down to 200 kHz, these links must be removed prior to operation with an l.f. adaptor.

- (1) Connect the 1 MHz OUT socket of the receiver to the 1 MHz input of the L. F. Adaptor.
- (2) Connect pin K of SKT 11 (l.f. h.t.) to the h.t. terminal on the L. F. Adaptor unit.
- (3) Connect pin L of SKT 11 (l.f. a.g.c.) to the a.g.c. input terminal of the L. F. Adaptor unit.
- (4) Connect the antenna feeder to the antenna socket of the L. F. Adaptor unit.
- (5) Connect the signal output of the L. F. Adaptor unit to the socket marked 'LF' on the RA. 1217. Use 75 $\Omega$  coaxial cable.
- (6) Turn the MHz tuning control of the RA. 1217 fully anti-clockwise against its stop. The MHz drum should indicate '00'.
- (7) Refer to the L. F. Adaptor handbook and set switches as required.
- (8) Tune the RA. 1217 as described in Chapter 3. Do not move the MHz tuning control.

## I. S. B. ADAPTOR CONNECTIONS

24. The following instructions apply to the I. S. B. Adaptor Type RA. 298 C & D.

- (1) Remove the 1.7 MHz crystal from the i.f. converter in the i.f. module of the receiver, and store in a safe place.
- (2) Connect SKT 2 (100 kHz OUT) to the 100 kHz input of the I. S. B. Adaptor.
- (3) Connect SKT 3 (1.7 MHz IN/OUT) to the socket "1.7 MHz to receiver" on the I. S. B. Adaptor.
- (4) Connect pin H (Diversity A. G. C.) of the 12-way socket SKT 11 to the AGC pin of the 12-way outlet PL1 on the I. S. B. Adaptor.
- (5) Connect pin E of SKT 11 (-16V HT) to the -16V pin of PL1 on the I. S. B. Adaptor.

- (6) Connect pin J of SKT11 (screen) to the 0 volt (earth) pin of PL1 on the I.S.B. Adaptor.

Refer to the RA.298 Technical Manual for further details.

(Refer to the next page for data on input and output levels.)

## REAR PANEL SOCKETS

### CONCISE DATA

TABLE 1

#### External Inputs

NOTE: All external source impedances are 75 ohms.  
If the voltage applied to the receiver exceeds  
100 mV an attenuating connector must be used.

Facility	Frequency	Socket	Level (Nominal)
1 MHz frequency Reference	1 MHz	1 MHz IN	100 mV e.m.f.
Kilohertz tuning (Synthesizer)	3.6 to 4.6 MHz	2nd V.F.O. IN	100 mV e.m.f.
Final i.f. Converter Heterodyne	1.7 MHz  1.145 MHz	{ 1.7 MHz IN/OUT 1.145 MHz IN/OUT	} 100 mV e.m.f.

TABLE 2

#### External Outputs

Facility	Socket	Level r.m.s.	Termination
1.6 MHz I.F.	1.6 MHz OUT	100 mV	High Z
1.7 MHz oscillator	1.7 MHz IN/OUT	50 mV	75 $\Omega$
100 kHz I.F.	100 kHz OUT	270 mV	75 $\Omega$
1.145 MHz oscillator	1.145 MHz IN/ OUT	50 mV	75 $\Omega$
455 kHz I.F.	455 kHz OUT	220 mV	50 $\Omega$
1 MHz reference	1 MHz OUT	50 mV	75 $\Omega$
3.6 - 4.6 MHz	2nd V.F.O. OUT	50 mV	75 $\Omega$

## CHAPTER 3

### OPERATING INSTRUCTIONS

#### INTRODUCTION

1. Before operating the receiver check that it has been prepared for service in accordance with the information in Chapter 2.

CAUTION: Before switching on for the first time check that the A. C. /D. C. switch and voltage selector switch at the rear of the receiver are correctly set.

#### FUNCTIONS OF CONTROLS

2. References to the controls and their settings are in capital letters in accordance with the engraving on the front panel.

#### SYSTEM SWITCH

- (1) This switch provides facilities for power OFF, MAN, CAL, CHECK B.F.O. and three alternative A.G.C. time-constants. Moving the switch from the OFF position to any other setting connects the external power supply to the power module.
- (2) MAN. In the MAN. position the receiver a.g.c. system is not operative, and the receiver gain is controlled manually by the R.F. GAIN control.
- (3) A.G.C. settings: The use of the time-constants SH (short) MED (medium) and LG (long) is dependent upon operating mode and propagation conditions.
- (4) CAL. In the CAL position, harmonic frequencies derived from a crystal source, provide audio marker notes at discrete 100 kHz intervals of the kHz tuning scale. The tuning scale may be corrected by using the CAL-FINE TUNE control.
- (5) Check B.F.O. In this position the B.F.O. frequency may be set to coincide with the i.f. centre frequency by setting the B.F.O. MODE switch to the '0' position and adjusting the B.F.O. TUNE kHz control to provide an audio null.

R.F. RANGE CONTROL (large knob)	This switch provides for the selection of any one of five frequency ranges, or a wideband (WB) position. The selected range (or WB) is displayed in a small aperture adjacent to the switch. The WB position is very suitable for signal search, but if strong interference is present care must be taken to avoid tuning to an adjacent channel instead of the wanted signal.
R.F. TUNE CONTROL (centre knob)	This control tunes the coil selected by the R.F. RANGE switch. Four tuning marks are engraved adjacent to the control, which together with the associated groups of figures, indicate the approximate frequency for each range at the point of rotation. If maximum sensitivity is not required the antenna need not be tuned, but the presence of strong interfering signals anywhere within the spectrum may cause cross-modulation unless the antenna is tuned.
AE ATT CONTROL. (Antenna Attenuator)	This control may be used to reduce the level of all incoming signals, and it must be used when strong interfering signals are present which cannot be entirely eliminated by use of the R.F. TUNE control, or if the wanted signal is sufficiently powerful to cause overloading of the earlier stages. Very strong signals should be reduced by the use of the AE ATT control rather than by turning down the R.F. GAIN or A.F. GAIN controls.
MHz	This control is the electronic band selector which selects the megahertz portion of the required signal frequency. The control should be set so that the required megahertz, digits are displayed on the tuning readout. A locking arm which projects from behind the knob can be moved fully clockwise to mechanically lock the control. By setting the MHz control to indicate '00', microswitches are actuated which connect power and a. g. c. lines for use in the L.F. Adaptor Type RA.337. Alternatively, the '00' setting can be used for reception down to approximately 200 kHz provided the microswitches have been linked out. Refer to Chapter 2 for information on the links.
kHz	This control selects the last three digits of the required frequency which are displayed on the tuning readout. The final digit in the readout is marked in divisions to permit a setting accuracy of 0.2 kHz. To avoid the necessity to reset the MHz control when tuning through either end of the band the kHz scale has upper and lower extensions of approximately 25 kHz. Thus when the scale is tuned below 000 kHz a minus sign appears in the readout, indicating that the true frequency

kHz (Cont'd)

is one megahertz less than the figure indicated by the MHz display. Conversely, when the kHz tuning is set above 999 a + sign appears indicating that the true frequency is one megahertz higher than the displayed MHz digits. A locking arm, similar to that on the MHz control, can be moved anti-clockwise to lock the kHz control.

2nd V.F.O.  
Switch  
(EXT - INT)

In the INT position the kHz tuning control operates normally, using the internal 2nd v.f.o. as already described. In the EXT position an external 3.6 to 4.6 MHz source such as a synthesizer or master receiver can be connected to take the place of the 2nd V.F.O. and the kHz tuning control is not operative.

R.F. - A.F.  
LEVEL  
Switch and  
Meter

This switch connects the meter to monitor either the r.f. signal level or the a.f. level of the 1 mW audio line. The meter is calibrated as an 'S' meter in decibels relative to 1 microvolt. A zero setting adjuster (located within the receiver) is operative in the R.F. position of the Meter switch. (Fig. 18)

DET-B.F.O.  
MODE and  
B.F.O. TUNE  
kHz

The positions L.S.B. and U.S.B. select off-set crystal oscillators for single sideband reception. The A.M. position provides reception without use of b.f.o. The positions +6 through to -6 provide coarse settings of the b.f.o. heterodyne note. In each of the coarse settings a fine adjustment of the b.f.o. note can be made by the adjacent B.F.O. TUNE kHz control, which provides a variation of approximately plus or minus 3 kHz.

I.F. BW kHz

This switch is marked in the i.f. bandwidths which are provided by crystal filters. Each passband is symmetrical about the i.f. centre frequency. A choice of bandwidths is available at customers option, as follows.

<u>Full Range</u>	<u>Standard Range</u>
kHz	kHz
0.2	0.2
1.2	---
3.0	3.0
8.0	8.0
13.0	---

R.F. GAIN and A.F. GAIN These are concentric controls. The R.F. GAIN is the smaller (central) knob. It functions only in the MAN position of the System switch, in which it manually biases the a.g.c. line. In accordance with normal operating practice the R.F. GAIN should be set to the minimum level consistent with the best signal-to-noise ratio.

The A.F. GAIN is the larger (peripheral) control. It adjusts the audio level to the headphones and the 1 watt audio output at the rear panel.

A.F. LEVEL A preset control which is entirely independent of the A.F. GAIN control. It sets the level of the 1 mW audio line output.

DIMMER This control adjusts the brightness of the tuning readout illumination.

### CALIBRATION

The kHz readout and the b.f.o. should be calibrated before using the receiver.

#### kHz Readout Calibration

3.
  - (1) Insert a pair of high impedance headphones into the PHONES socket.
  - (2) Set the System switch to CAL
  - (3) Set the DET-B.F.O. MODE switch to A.M.
  - (4) Set the IF BW switch to 3.0 kHz
  - (5) Set A.F. GAIN control to the mid-position.
  - (6) Turning the kHz tuning control should result in beat notes being heard at each multiple of 100 kHz.
  - (7) Set the kHz tuning control accurately to the 100 kHz multiple which is nearest to the operating frequency required, and adjust the CAL-FINE TUNE control to produce a null in the beat note. To retain calibration the CAL-FINE TUNE control should not be moved.

### B.F.O. Calibration

4.
  - (1) Insert the headphones in the PHONES socket.
  - (2) Set the DET - B.F.O. MODE switch to '0'
  - (3) Set the System switch to CHECK B.F.O.
  - (4) Adjust the B.F.O. TUNE kHz control for a null in the beat note, which should occur approximately in the mid position of the control movement.

### RECEIVER TUNING

NOTE: The following procedure is given as a general guide to the correct use of the controls.

5.
  - (1) Connect the headphones
  - (2) Set the LOCK controls to 'off' (upwards)
  - (3) Set the System switch to A.G.C. MED
  - (4) Set the R.F. RANGE switch to WB (wideband)
  - (5) Set the AE ATT control to MIN (fully clockwise)
  - (6) Set the DET-B.F.O. MODE as required (refer to (14) below)
  - (7) Set the MHz tuning control to indicate the required frequency in megahertz on the readout indicator, then lock the control
  - (8) Set the kHz, tuning control to indicate the required kilohertz reading on the the readout indicator. The scale divisions on the final figure will facilitate precise tuning.

NOTE: When operating with the R.F. RANGE switch set to WB it is possible for strong interfering signals to render station identification difficult. In such conditions the AE ATT control should be turned one or two steps from MIN towards MAX to obtain the best signal-to-noise ratio consistent with the satisfactory elimination of cross-modulation effects.

- (9) Adjust the kHz tuning to identify the required signal.
- (10) Set the R.F. RANGE switch to the appropriate frequency range.
- (11) Adjust the R.F. TUNE control for maximum signal strength. The markings adjacent to the control give a guide to the approximate tuning point.



- (12) Make fine adjustments of kHz tuning, R.F. TUNE and A.F. GAIN controls for optimum clarity and level of signal.
- (13) If signal strength is excessive, set the AE ATT control in an anti-clockwise direction and re-adjust the A.F. GAIN control for a satisfactory audio level.
- (14) Set the DET-B.F.O. MODE switch to A.M. for A2 or A3 reception, or to a setting between +6 and -6 for A1. Adjust the variable B.F.O. TUNE control for the required pitch of beat note on c.w. or f.s.k.
- (15) Lock the kHz tuning control
- (16) The CAL-FINE TUNE control may be used for fine tuning, if necessary.

NOTE: When the CAL-FINE TUNE control has been used for fine tune purposes it will be necessary to perform the kilohertz calibration procedure (para. 3) whenever precise kHz readout accuracy is again required.

#### Single Sideband Reception

- 6.
  - (1) Tune the receiver as instructed in paragraph 5 except that in operation (6) the DET-B.F.O. MODE switch must be set to L.S.B. for lower sideband reception, or to U.S.B. for upper sideband reception.
  - (2) Set the I.F. BW switch to 3 kHz.
  - (3) Adjust the kHz tuning control to obtain the strongest and clearest audio signal.
  - (4) Lock the tuning controls and make fine tuning adjustments with the CAL-FINE TUNE control to clarify the signal.

#### Operating with a Synthesizer

- 7.
  - (1) Check that the synthesizer is correctly connected as instructed in Chapter 2.
  - (2) Check that the 2nd V.F.O. switch on the RA.1217 is set to EXT.
  - (3) Switch on the synthesizer and allow a suitable warming-up period (minimum 15 minutes ; recommended 3 hours.)
  - (4) Tune the receiver as instructed in para.5 of this chapter, but in operations (8) and (12) the kilohertz frequency is set on the

synthesizer dials. The receiver kHz, tuning control is not in use and the CAL-FINE TUNE control cannot be used for fine tune purposes. Refer to the synthesizer handbook for kHz tuning instructions.

#### Operating with an L.F. Adaptor

8.
  - (1) The l.f. adaptor should be connected to the receiver as instructed in Chapter 2. The antenna should be connected to the l.f. adaptor.
  - (2) Set the MHz tuning control on the RA.1217 fully anticlockwise so that '00' is indicated on the megahertz readout.
  - (3) Set the RA.1217 System switch to A.G.C. (MED)
  - (4) Tune the RA.1217 using the kHz control only. The MHz control R.F. RANGE, R.F. TUNE and AE ATT controls are not in use. The remaining controls may be used as in normal operating.

#### ADDITIONAL OPERATING INFORMATION

##### Receiving Down to 200 kHz

9. The following modification will give reception down to approx.200 kHz but with degraded performance.
  - (1) At the rear of the receiver link the terminal 'h.t., l.f.' to terminal 'h.t., r.f.'
  - (2) Link terminal 'a.g.c., l.f.' to terminal a.g.c., r.f.' This bypasses the micro-switches which normally disconnect h.t. and a.g.c. from the receiver input stages when the MHz tuning is set to '00'.
  - (3) Set the 'MHz' tuning control to indicate '00' on the MHz readout. Lock the control.
  - (4) Tune with the kHz control and all other controls in the normal way.

NOTE: The links should be removed when an L.F. Adaptor unit is to be connected.

## CHAPTER 4

### BRIEF TECHNICAL DESCRIPTION

#### INTRODUCTION

1. This chapter describes the basic principles of the receiver design. Only the more significant design features will be referred to. A detailed description of the circuits is given in the Maintenance Handbook. Throughout this chapter reference should be made to the block diagrams, Fig. 2 and Fig. 3 at the rear of the book.

#### WADLEY SYSTEM

2. The main feature of the receiver is the tuning system which is based on a principle often referred to as the 'Wadley system' (fig. 2). This system is specifically designed to counteract frequency drift. Its most characteristic features are that the tuning system is separated into MEGAHERTZ and KILOHERTZ tuning, and no mechanical band switching is required, although pre-tuning of the antenna circuit may be provided.
3. The 'Megahertz' tuning section selects a 1 MHz band of signal frequencies, which contains both wanted and unwanted signals, and transfers this band of frequencies to the 'Kilohertz' section. The 'Kilohertz' section serves as an interpolation receiver, and selects the wanted signal from within this 1 MHz band. It is essential to grasp this conception of a spectrum of frequencies being transferred, rather than a single frequency as in a conventional superheterodyne system.

#### MEGAHERTZ TUNING SECTION

##### Drift Cancellation

4. The 'Megahertz' tuning system is specifically designed to eliminate the effects of drift in the first v.f.o. stage. Any tendency for the receiver to drift off tune due to first v.f.o. instability is automatically corrected by a technique of self-cancelling frequency change.
5. For descriptive purposes the system may be divided into two loops which will be referred to as the 'signal loop' and the 'harmonic mixer loop'. The first v.f.o. is tuned by the Megahertz tuning control, and its output is supplied to both loops.
6. In the signal loop one of the first v.f.o. outputs is mixed with the incoming r.f. signals to produce an output spectrum slightly more than 1 MHz wide. In the harmonic mixer loop another output from the first v.f.o. is mixed with a harmonic from a 1 MHz crystal oscillator. These separate mixer outputs are filtered and then subtracted in the second mixer stage. Since the first v.f.o. has contributed equally to both loops, any drift in the signal loop is

cancelled by an equivalent drift in the harmonic mixer loop. Thus drift or displacement of the first v.f.o. frequency has no effect on the receiver output. The stability of the Megahertz section is determined by the 1 MHz reference oscillator. This crystal oscillator can be replaced by an external 1 MHz source of even greater stability, if required. The following paragraphs describe the 'Megahertz' tuning in more detail.

#### Signal Loop

(Fig. 3)

7. This loop comprises the r.f. input stage, the first mixer, the first v.f.o. and the 40 MHz band-pass filter. Incoming r.f. signals between 0.98 MHz and 30 MHz are amplified and fed to the first mixer, together with an output from the first v.f.o. This produces a frequency spectrum (first i.f.) centred on 40 MHz with a bandwidth of  $\pm 650$  kHz at the output from the 40 MHz band-pass filter. This 1 MHz spectrum contains the wanted signal together with other, unwanted signals.
8. The first v.f.o. can be tuned by the Megahertz (MHZ) control over the range 41.5 MHz (setting 01) to 69.5 MHz (setting 29). At each setting there will be a particular 1 MHz spectrum within the 0.98 to 30 MHz signal range which will produce an output from the first mixer which can pass through the 40 MHz band-pass filter. Thus, by tuning the first v.f.o. the entire signal range of 0.98 to 30 MHz can be selected in discrete 1 MHz steps without mechanical band switching. It should be noted that the passband of the 40 MHz filter exceeds 1 MHz by a tolerance of  $\pm 150$  kHz. This will be referred to later. A separate 29-channel oscillator unit can be supplied which replaces the first v.f.o., thus providing remotely controlled 'megahertz' tuning.

#### Harmonic Mixer Loop

9. This loop comprises the 1 MHz crystal oscillator, the harmonic generator, the harmonic mixer and the 37.5 MHz band-pass filter. The 1 MHz oscillator drives the harmonic generator which produces a wide range of harmonics of the 1 MHz crystal. An output from the first v.f.o. is applied to the harmonic mixer together with all the harmonics (up to the 32nd) of the 1 MHz crystal.
10. The output of the harmonic mixer is a band-pass filter with a pass-band of plus or minus 150 kHz centred on 37.5 MHz. Thus, whatever the setting of the first v.f.o. tuning, an output is obtained only when the first v.f.o. frequency minus a harmonic of 1 MHz crystal produces 37.5 MHz. This occurs at discrete 1 MHz steps in the first v.f.o. tuning range, therefore the Megahertz tuning control must always be set in 1 MHz steps.
11. It will be noted that the passband of the 37.5 MHz filter is the same ( $\pm 150$  kHz) as the tolerance in the 40 MHz band-pass filter. This is the permitted allowance for first v.f.o. drift or tuning error, from which it is evident that the setting of the Megahertz tuning control is not critical. The control should, however, always be set to the point of maximum receiver noise, thus ensuring that the mixer output frequencies are centred in their respective filter passbands.

## Second Mixer

12. The signal loop and the harmonic mixer loop are brought together in the second mixer where the 37.5 MHz is subtracted from the 1 MHz spectrum (39.5 MHz to 40.5 MHz) of the signal loop. The resultant output (2nd i.f.) is a 1 MHz spectrum covering the range 2 MHz to 3 MHz. This is amplified, filtered to a more exact 1 MHz bandwidth, and applied to the third mixer, where, by means of the second v.f.o. the 'Kilohertz' tuning is performed. Numerical examples of 'Megahertz' tuning are given in the next paragraph.

## Examples of Megahertz Tuning

13.

TABLE 1

(1) MHz control set to ..... 5 MHz

<u>Signal Loop</u>	<u>MHz</u>	<u>Harmonic Loop</u>	<u>MHz</u>
VFO - 1	45.5	VFO - 1	45.5
Signal	5 to 6	Harmonic (8)	8.0
Frequency			
1st i.f.	39.5 to 40.5	Mixer Output	37.5

2nd Mixer

2nd I. F. = 2 to 3 MHz

(2) MHz control set to ..... 29 MHz

<u>Signal Loop</u>	<u>MHz</u>	<u>Harmonic Loop</u>	<u>MHz</u>
VFO - 1	69.5	VFO - 1	69.5
Signal	29 to 30	Harmonic (32)	32.0
Frequency			
1st i.f.	39.5 to 40.5	Mixer Output	37.5

2nd Mixer

2nd I. F. = 2 to 3 MHz

## KILOHERTZ TUNING

### Third Mixer and Second V. F. O.

14. The 2 to 3 MHz second i.f. spectrum contains the wanted signal. This signal frequency is precisely tuned in the third mixer stage by the second v.f.o. (KHZ tuning) which has a tuning range of 3.6 to 4.6 MHz. This second v.f.o. output is mixed with the second i.f. and the difference frequency of 1.6 MHz becomes the third intermediate frequency. Thus the third mixer and second v.f.o. may be regarded as an interpolation receiver operating over the range 2 to 3 MHz. For optimum stability the second v.f.o. may be replaced by an external frequency synthesizer or controlled by an automatic frequency stabilizer such as the "Racalator".

## Frequency Inversion

15. It should be noted that the 1 MHz spectrum in the antenna circuit is transferred and inverted to a 3 to 2 MHz spectrum in the second i.f. stage. For example a 15.45 MHz signal becomes 2.55 MHz in the second i.f. stage, and a 15.75 MHz r.f. signal becomes 2.25 MHz. This inversion is of no significance to the user unless the design or suitability of an l.f. adaptor or synthesizer is under consideration. The inversion arises because the first v.f.o. frequency is above the signal frequency whereas the harmonic mixer output (37.5 MHz) is below the first i.f. A frequency from the harmonic mixer which is higher than the first i.f. cannot be employed as it would require for its generation a harmonic of zero order when tuned to the 2 to 3 MHz signal band. (1st V.F.O. tuned to 42.5 MHz).

## Calibration

16. The setting accuracy of the kilohertz tuning control can be checked at 100 kHz intervals by means of a calibrator circuit when the system switch is set to CAL. The calibrator circuit generates a 100 kHz fundamental obtained from a divider circuit driven by the 1 MHz crystal reference source. The 100 kHz is fed to the third mixer where the harmonics beat with the second v.f.o. frequency. The kHz control is set to indicate a multiple of 100 kHz and the CAL-FINE TUNE control on the front panel is then adjusted to shift the 2nd v.f.o. frequency which produces a zero beat frequency in the phones.

17. The CAL-FINE TUNE control is a variable resistor which adjusts the bias on a varactor diode in the second v.f.o. tuned circuit. This control can also be used to make fine adjustments of signal tuning when, for example, the main tuning controls are locked. The frequency range of the fine tune adjustment varies over the kilohertz tuning range but should be not less than 8 kHz.

## L. F. Adaptor Unit

18. To receive frequencies lower than 0.98 MHz an external l.f. adaptor is required, the output from which is a 1 MHz spectrum in the band 2 to 3 MHz. This signal spectrum is fed into the second i.f. stage in lieu of the spectrum from the second mixer. When the l.f. adaptor is in use the receiver r.f. stage, first v.f.o., first mixer and harmonic mixer are not required and the h.t. supply to these stages is disconnected. Terminals on the rear panel of the receiver provide h.t. and a.g.c. connections for an l.f. adaptor unit. The h.t. and a.g.c. are automatically switched through to the l.f. adaptor when the receiver MHz tuning control is set to '00'.

## Panoramic Adaptor Unit

19. The 2 to 3 MHz second i.f. spectrum can be displayed on a panoramic adaptor unit, thus permitting visual display of the activity in any selected 1 MHz band of signals between 980 kHz and 30 MHz. (Down to 3 kHz if the l.f. Adaptor RA.337 is connected). The signal input to the Pan

Adaptor is taken from the coaxial outlet PAN at the rear of the receiver. The -16V and -24V power supplies for the Pan. Adaptor may be obtained from the RA.1217 receiver via the appropriate pins on the 12-way outlet.

## TABLE 2

### OVERALL TUNING EXAMPLE

#### RA.1217 Tuned to a Signal of 15.48 MHz

##### Dial Settings

Megahertz control set to indicate	..... 15
Kilohertz control set to indicate	.....480

##### Signal Loop

	<u>MHz</u>
VFO - 1 Tuning (MHZ) set to	..... 15
VFO - 1 Frequency (40.5 +15)	..... 55.5
1st i.f. spectrum (55.5 minus 15 to 16)	..... 39.5 to 40.5
Wanted signal within the spectrum is 55.5 minus 15.48	..... 40.02

##### Harmonic Mixer Loop

VFO - 1 frequency	..... 55.5
VFO - 1 minus 18th harmonic of 1 MHz	..... 37.5

##### 2nd Mixer

1st i.f. spectrum minus 37.5 MHz provides 2nd i.f.	..... 2 to 3
Wanted signal within the 2nd i.f. spectrum is 40.02 minus 37.5 MHz	..... 2.52

##### 3rd Mixer and 2nd VFO

VFO - 2 tuning (KHZ) set to 480 which tunes VFO - 2 to required setting (2.52 +1.6)	..... 4.12
3rd i.f. is (4.12 minus 2.52) which is	..... 1.6

##### 100 kHz i.f. Converter

Converter oscillator (1.7 MHz) minus 3rd i.f. (1.6 MHz)	.....100 kHz
--	--------------

##### 455 kHz i.f. Converter

1.6 MHz minus converter osc. (1.145 MHz)	.....455 kHz
---	--------------

## FINAL I. F. STAGES

20. The final intermediate frequency used within the receiver is 1.6 MHz. Four amplifiers at this frequency provide the greater part of the receiver gain. Crystal band-pass filters are included to provide the requisite selectivity. An additional intermediate frequency is available for external use with ancillary equipment such as an i. s. b. adaptor, f. s. k. converter, etc. The particular external frequency available (either 100 kHz or 455 kHz) is dependent upon the type of i. f. module fitted to the receiver and should be specified by the purchaser. (Refer also to para. 32).

## A. G. C. CIRCUITS

21. A. G. C. is obtained by detecting an output from the 1.6 MHz i. f. Three time-constants are available, selected by the System Switch. An interconnection via the I. F. Bandwidth switch ensures that the short time-constant is not operative whenever the I. F. Bandwidth switch is set to either 0.2 or 1.2 kHz. If the System switch is set to A. G. C. SH (short) the Bandwidth switch inserts A. G. C. medium time-constant whenever either of these narrow bandwidths are selected. The receiver gain can be controlled from an external a. g. c. source such as a companion diversity receiver, or an i. s. b. adaptor etc.

## R. F. GAIN Control

22. In the MAN position of the System switch the a. g. c. line is disconnected from the a. g. c. source and a manually controlled bias derived from -16V via the R. F. GAIN control is substituted. In all other settings of the System switch the R. F. GAIN control has no function

## DETECTOR AND B. F. O. CIRCUITS

### Detector Circuits

23. The detector circuit has two separate functions:
- (a) As a product detector in all positions of the B. F. O. switch except A. M.
  - (b) As an a. m. demodulator in the A. M. position of the B. F. O. switch.
24. Product Detector. The output from the i. f. amplifier stage is fed to the product detector together with one of the following frequencies, dependent upon the setting of the B. F. O. switch.
- (a) 1601.5 kHz (B. F. O. switch at L.S. B.)
  - (b) 1598.5 kHz (B. F. O. switch at U.S. B.) or
  - (c) A 1.6 MHz frequency which is variable by means of the B. F. O. TUNE control. (B. F. O. switch at +6 through -6).



25. A. M. Detector. In the A. M. position of the B. F. O. switch the 1.6 MHz i. f. signal is demodulated. The B. F. O. frequencies referred to in the previous paragraph are switched out.

#### B. F. O. Circuits

26. CW (A1) Reception. The local heterodyne oscillator provides a 600 kHz nominal frequency which can be varied through a range of plus or minus 9 kHz by suitable combinations of the switch settings +6 to -6, and variable adjustment of the B. F. O. TUNE control.

#### B. F. O. Circuits

27. The variable 600 kHz output is fed via a buffer amplifier to a mixer on the detector board in the i. f. module. A fixed frequency of 1 MHz from a crystal oscillator (the same source as that which drives the harmonic generator) is supplied to the same mixer. The combined output at 1.6 MHz (plus or minus any variation applied to the 600 kHz via the B. F. O. TUNE control) is supplied to the product detector stage to heterodyne the 1.6 MHz intermediate frequency.

28. Single-Sideband Reception. The positions L. S. B. and U. S. B. on the B. F. O. switch provide electronic switching of two oscillator frequencies on the detector board. In the L. S. B. setting a crystal controlled frequency of 1601.5 kHz is generated. This is fed to the product detector stage to serve as a stable inserted carrier 1.5 kHz above the 1.6 MHz i. f. thus permitting lower sideband reception. In the U. S. B. setting of the B. F. O. switch a 1598.5 kHz crystal is substituted in the oscillator circuit which then provides carrier insertion 1.5 kHz below the 1.6 MHz i. f. thus facilitating upper sideband reception. The 3 kHz i. f. bandwidth setting should be used so that the inserted carrier is placed at one edge of the filter thus allowing the required sideband to occupy the whole of the passband.

29. It may be noted that the mixer to the 1 MHz and 600 kHz frequencies (para. 27) becomes an amplifier when the B. F. O. switch is set to L. S. B. or U. S. B. The 600 kHz b. f. o. is switched off, thus there is no variable b. f. o. facility available when the L. S. B. or U. S. B. positions are selected.

#### AUDIO STAGES

30. The output from the a. m. detector or the product detector is fed via a buffer stage to an audio amplifier board located on the underside of the receiver. The standard amplifier supplies the following outputs.

- (a) 1 mW in 600 ohms for line use.
- (b) 10 mW into 600 ohms.
- (c) 10 mW in 600Ω to the headphones outlet on the front panel.

The level of the 1 mW output is adjusted by the preset A.F. LEVEL control. The 10 mW output level is adjusted by the variable A.F. GAIN control. To special order an audio amplifier is available which provides outputs of one watt and one milliwatt. Refer to the Preface at the beginning of Chapter 1.

### I.F. CONVERTERS

31. Two alternative types of converter board are available for fitting into the i.f. module. The particular type fitted is determined whether the intermediate frequency output is required to be 100 kHz or 455 kHz.
32. The 1.6 MHz intermediate frequency is supplied to the converter board where it is mixed with the output from a crystal controlled oscillator, the difference frequency is the required final i.f. Thus if the final i.f. is to be 100 kHz the converter oscillator crystal is required to be 1.7 MHz. For an i.f. of 455 kHz a crystal frequency of 1.145 MHz is required. These crystal frequencies can be injected from an external source such as a synthesizer. When an external source is employed the internal crystal should be removed.

### POWER SUPPLY MODULE

33. The standard power module Type PU. 1153 is a plug-in unit which can operate from either a.c. or d.c. supplies. It provides outputs at -16V (regulated) and 20 to 24V nominal (unregulated) capable of supplying the power requirements of the receiver and also ancillary units such as an i.f. adaptor, i.s.b. adaptor etc. Refer to the Technical Specification at the front of this handbook for performance data.
34. The A.C. /D.C. and Voltage Selector switched must be correctly set before operating the receiver, as instructed in Chapter 2. Two fuses are provided; the 250 mA fuse protects the input when an a.c. supply is in use. The h.t. fuse, which is in circuit with both a.c. and d.c. power inputs, protects the -16V and -24V outputs.
35. The receiver has no independent power switch. The input to the power supply is connected via a pair of microswitches which are actuated when the System switch is moved from the OFF position.

## CHAPTER 5

### INITIAL FAULT LOCATION

#### INTRODUCTION

1. The advice in this chapter provides a simple test procedure which will assist the location of an elementary fault. It is assumed that the only instrument available is a universal testmeter, and that the receiver is not connected to a synthesizer, l.f. adaptor or other external unit. If the fault cannot be located it will be necessary to refer to the more detailed test procedures described in the RA. 1217 maintenance handbook.

#### PRELIMINARY CHECKS

2. If the receiver is newly installed check the following items:
- (a) AC/DC selector switch correctly set. (rear panel).
  - (b) 2nd V. F. O. switch set to INT (front panel).
  - (c) MHz tuning control not set to '00'
  - (d) Power connection: Note that the polarity of a d. c. supply must be correct. (Refer to Chapter 2).
  - (e) Antenna connected

#### INITIAL FAULT LOCATION PROCEDURE

##### Controls

3. Set the receiver as follows and check for signals or noise.
- (1) System switch to MAN
  - (2) DET-BFO switch to A. M.
  - (3) Meter switch to R. F.
  - (4) A. F. GAIN to maximum (clockwise)
  - (5) I. F. BW switch to 3 kHz
  - (6) R. F. GAIN to maximum (clockwise).
  - (7) AE ATT control to the MINIMUM position (MIN)
  - (8) R. F. RANGE switch to 'WB'.
  - (9) Ensure that the MHz tuning control is not set to '00'

##### General Diagnosis

4. The most useful indication in elementary fault diagnosis is receiver noise, or 'mush'. The controls should be set as listed in paragraph 3 and the receiver tuned over a suitable portion of the h. f. band. At each step of the MHz tuning control make a fine adjustment and

listen for a rise in receiver noise level. If no noise can be heard, check that the phones are serviceable and, if possible, listen at an alternative audio outlet as well as at the phones jack socket.

### POWER CHECK

5. If the receiver appears dead (no noise) and the dial lights are not illuminated, check the h.t. voltage in the receiver as follows:
  - (1) Connect the testmeter (30 volt d.c. range, or higher) to the terminal 'RF. HT' on terminal block TB1 at the rear of the receiver. The reading should be -16 volts relative to chassis. If no reading is obtained at this point it is probable that a fault exists in the power unit or power supply. If connected to a d.c. supply check that the polarity of the connections is correct. (Refer to Chapter 2).

### I. F. MODULE CHECK

6. If noise can be heard, vary the setting of the I. F. BW switch. A change of noise level at each switch movement indicates that the i.f. module is serviceable.
7. If no noise is heard, switch on the b.f.o. (DET-BFO switch to +3 or -3 kHz). The meter (R.F. position) should show a reading and b.f.o. noise should be heard. If a meter reading is obtained but no noise is heard, the fault may be in the detector board of the i.f. module, or in the audio amplifier and its connections. If b.f.o. noise is heard the fault may be in the i.f. amplifier stages of the i.f. module, or in various stages of the receiver prior to the i.f. module. Carry out a front end check.

### FRONT END CHECK

8. Set the DET-BFO switch to A.M. Listen intently and slowly rotate the MHz tuning control. If a very slight rise in noise level can be heard as the MHz tuning passes through each resonant point it suggests that the 37.5 MHz loop is functioning and therefore the fault is more likely to be in the antenna circuit, R.F. Module or 1st Mixer. Make the check in the WB setting of the R.F. RANGE switch as well as in the tuned antenna condition (adjust RF TUNE control). Thoroughly check all front end connections as follows:
  - (1) Check antenna.
  - (2) Check continuity through the 500 mA fuselink in the R.F. Module.
  - (3) Check that the antenna spark gap is not short circuited.
  - (4) Check the flying lead connections between the R.F. Module and the 1st Mixer, and between 1st VFO and 1st Mixer.

9. If, when tuning the MHz control as described in the previous paragraph, no noise can be heard, the 1st VFO or its connections may be faulty. Check connections from 1st V.F.O. to 1st Mixer and 37.5 MHz Generator at the bracket on the underside of the main chassis.

#### RF HT Check

10. On the terminal block TB1 at the rear of the receiver connect the terminal HT RF to the terminal HT LF. If the receiver then functions correctly the microswitch 1SB (Fig. 16, Fig. 18) should be checked.

#### 1 MHz Check

11. Set the System switch to CAL and tune the KHz control to the 100 kHz calibration check frequencies. If the calibration whistle is heard at each point it indicates that the 1 MHz oscillator is functioning. If no calibration whistles are heard, turn the System switch to CHECK BFO and set the DET-BFO switch to +6, +3, -3 and -6 kHz in turn. If, again, no heterodyne whistles are heard, it indicates a faulty 1 MHz crystal oscillator. Check that the crystal is correctly fitted in the upper deck of the 37.5 MHz Generator Module.

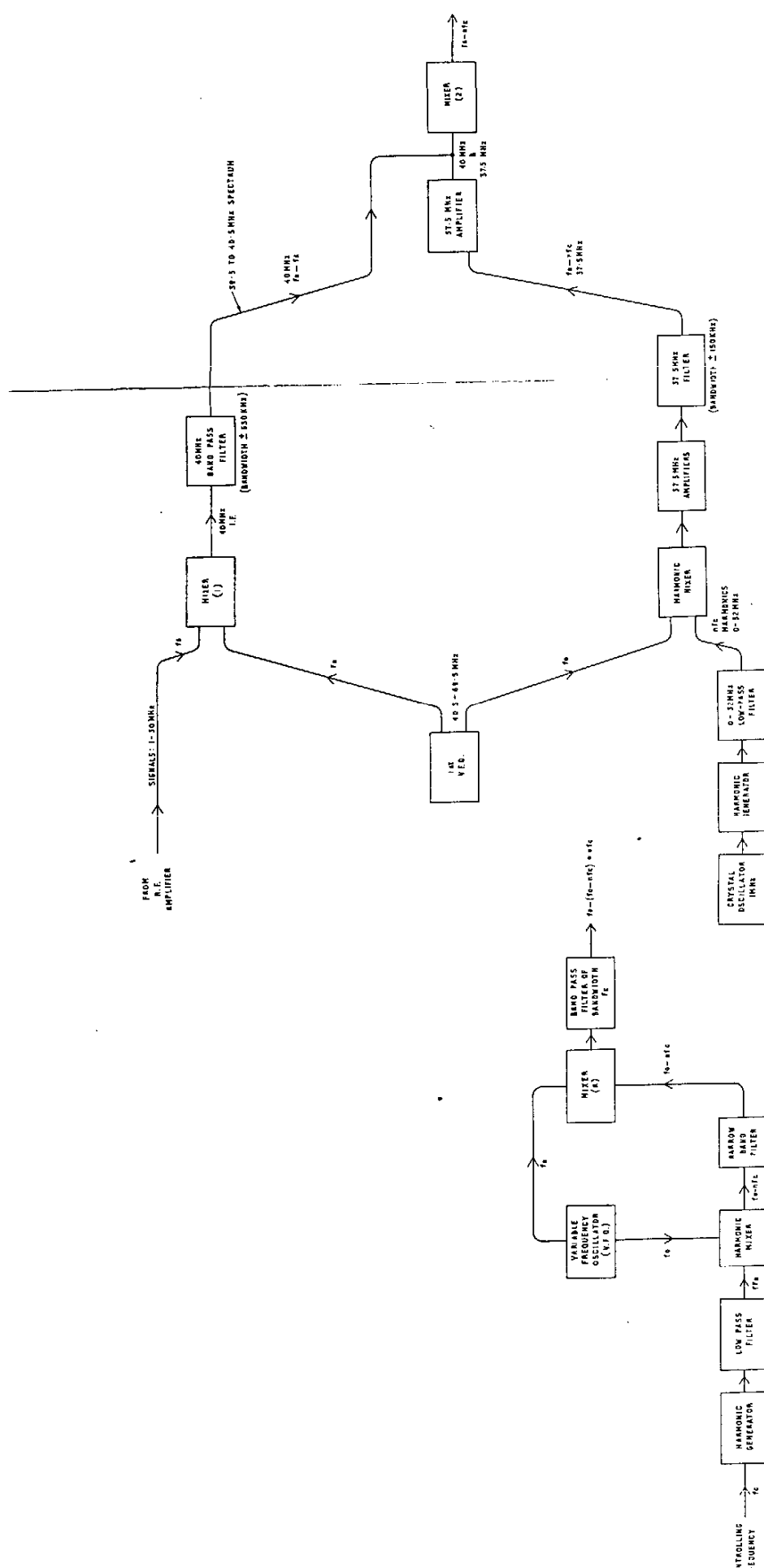
#### A.G.C. FAULT

12. If the receiver operates satisfactorily with manual r.f. gain control (System switch to MAN) but overloads on strong signals in the a.g.c. settings of the System Switch check as follows:

- (1) Tune the receiver to a strong signal. Set the System switch to AGC Med and the Meter switch to R. F. If the meter indicates a reading appreciably greater than 1 microvolt the a.g.c. board in the I. F. Module is serviceable. If no reading is obtained the fault is probably in the I. F. Module.
- (2) If the meter reading is satisfactory, connect the test meter negative lead to the terminal AGC RF on the rear panel (positive lead to chassis). As the receiver is tuned through a powerful signal the a.g.c. level should change from -4V (weak signal) to approximately 0 volts (strong signal). If no reading is obtained check the microswitch 1SA adjacent to the MHz tuning shaft. (Fig. 16 Fig. 18)

NOTE: The levels quoted in para. 12, cannot be given exactly because the level of a strong signal is not defined.

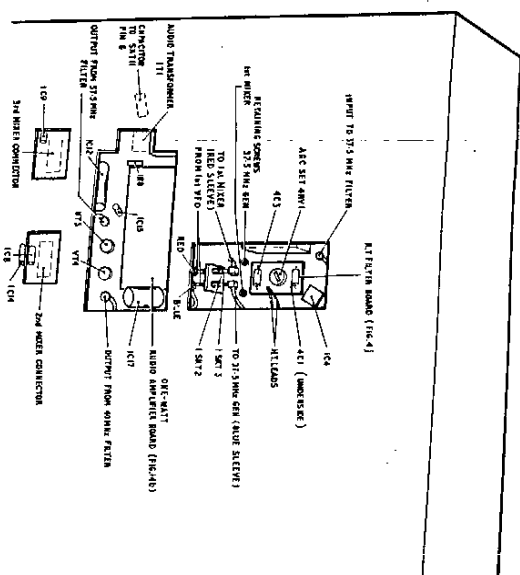




## Wadley System - Block Diagram

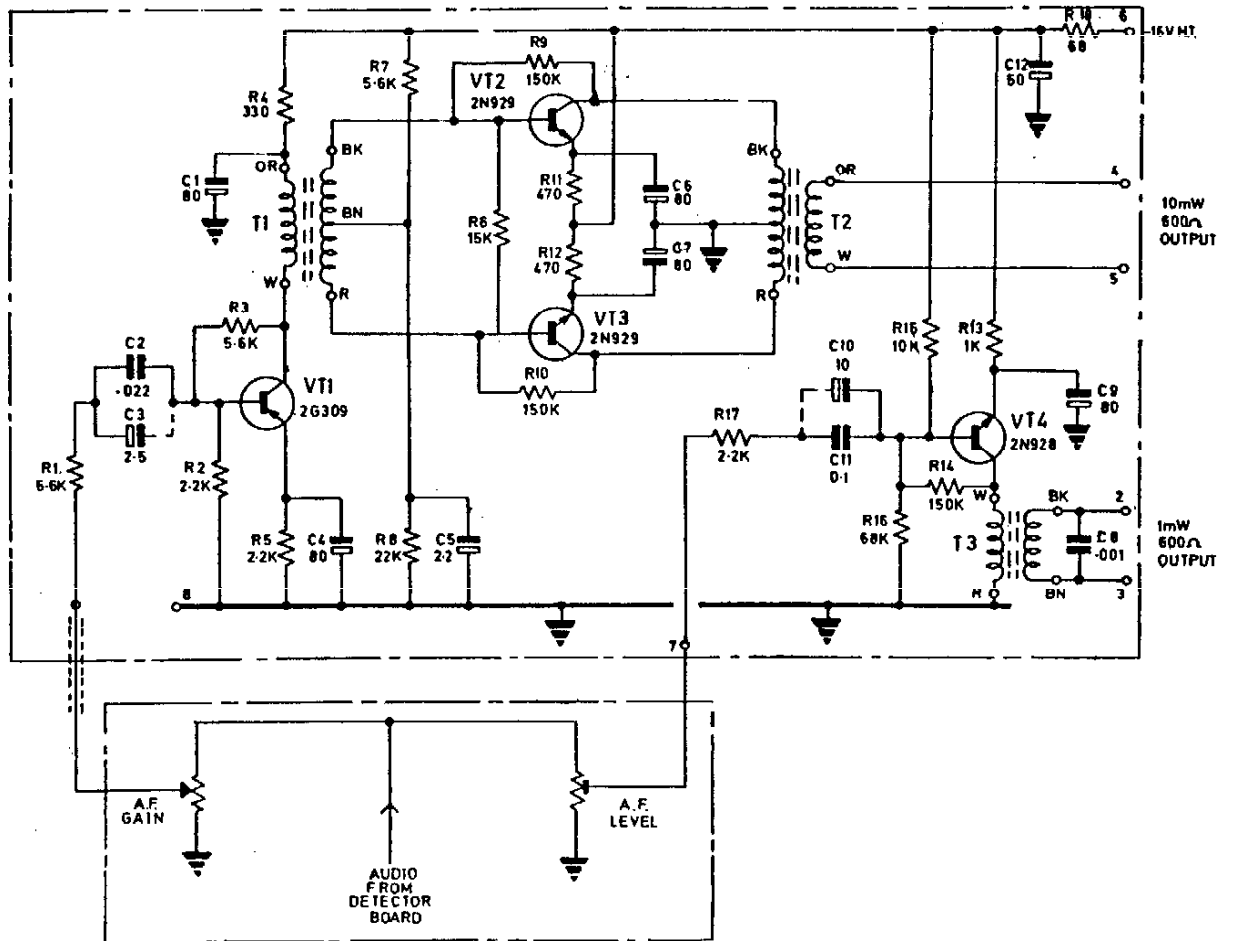
### Electronic Band Selection — Explanatory Block Diagram

Fig. 2



**Fig. 18**



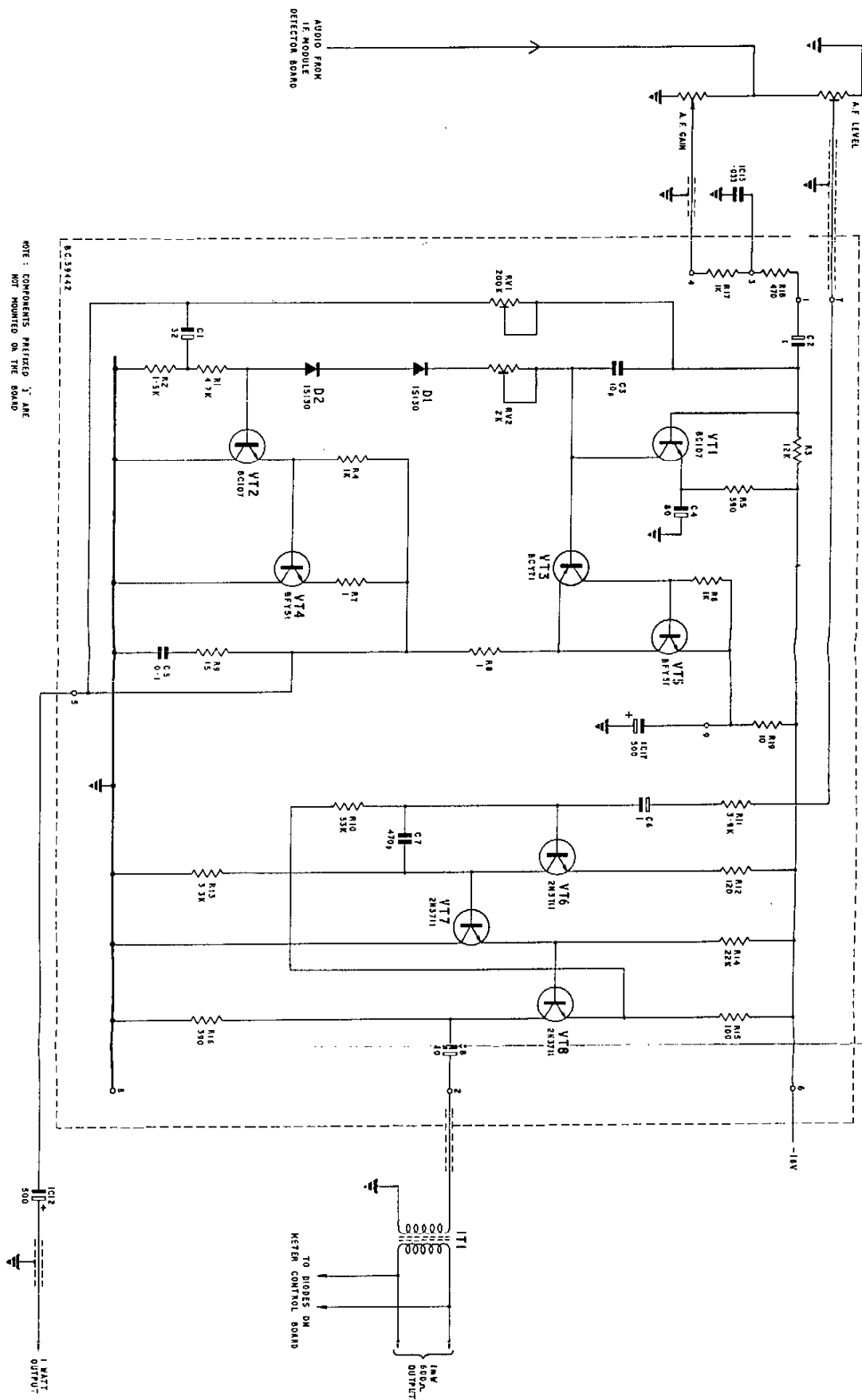


DC 38450	280/45
----------	--------

10mW Audio Amplifier Board

Fig. 14a



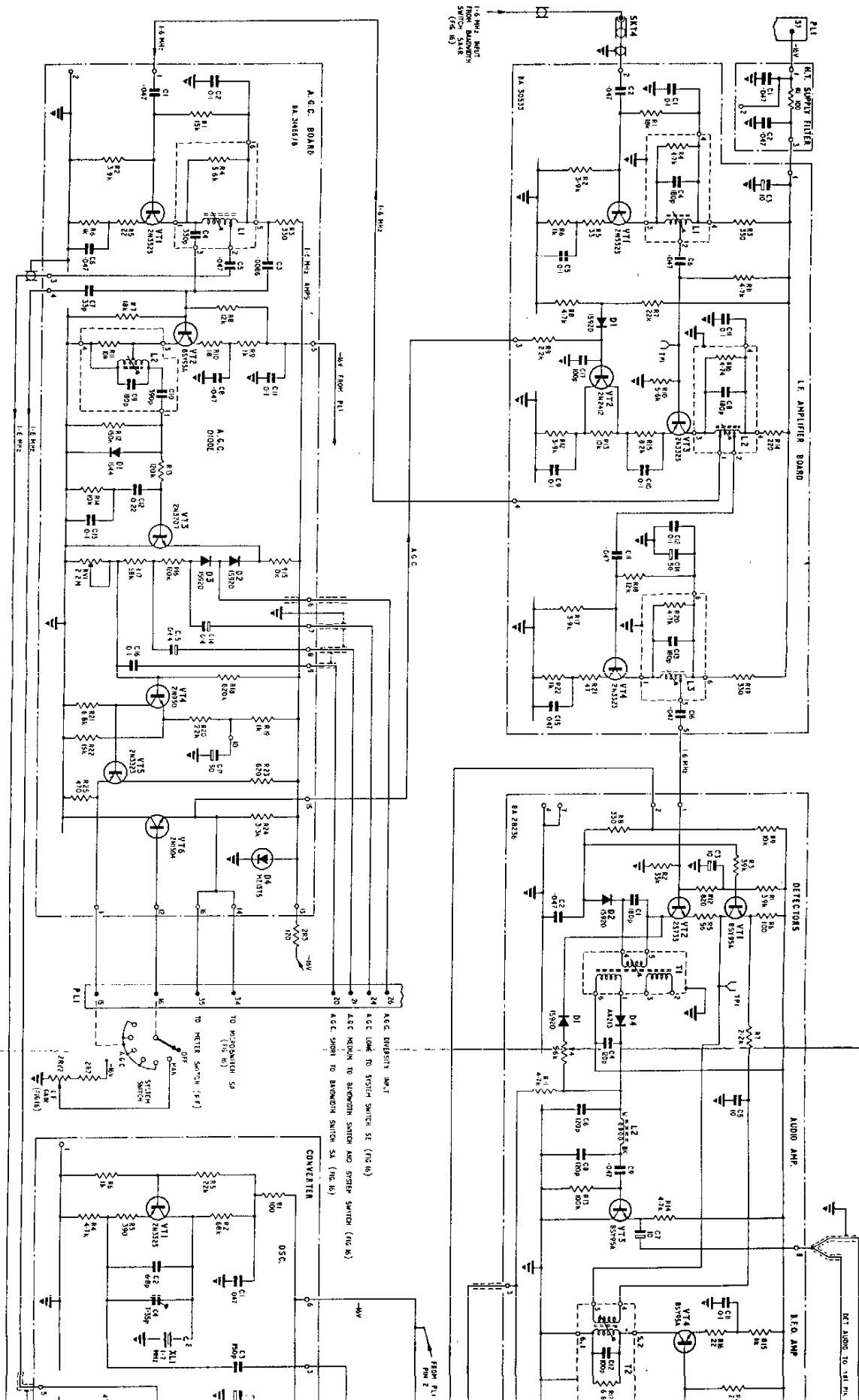


Circuit: Audio Amplifier Board  
(1 Watt)

PC 34450 281/11  
113



**Circuit : B.F.O. Unit**



Circuit : I.F. Module

PC34880 281/12

Circuit : I. F. Module

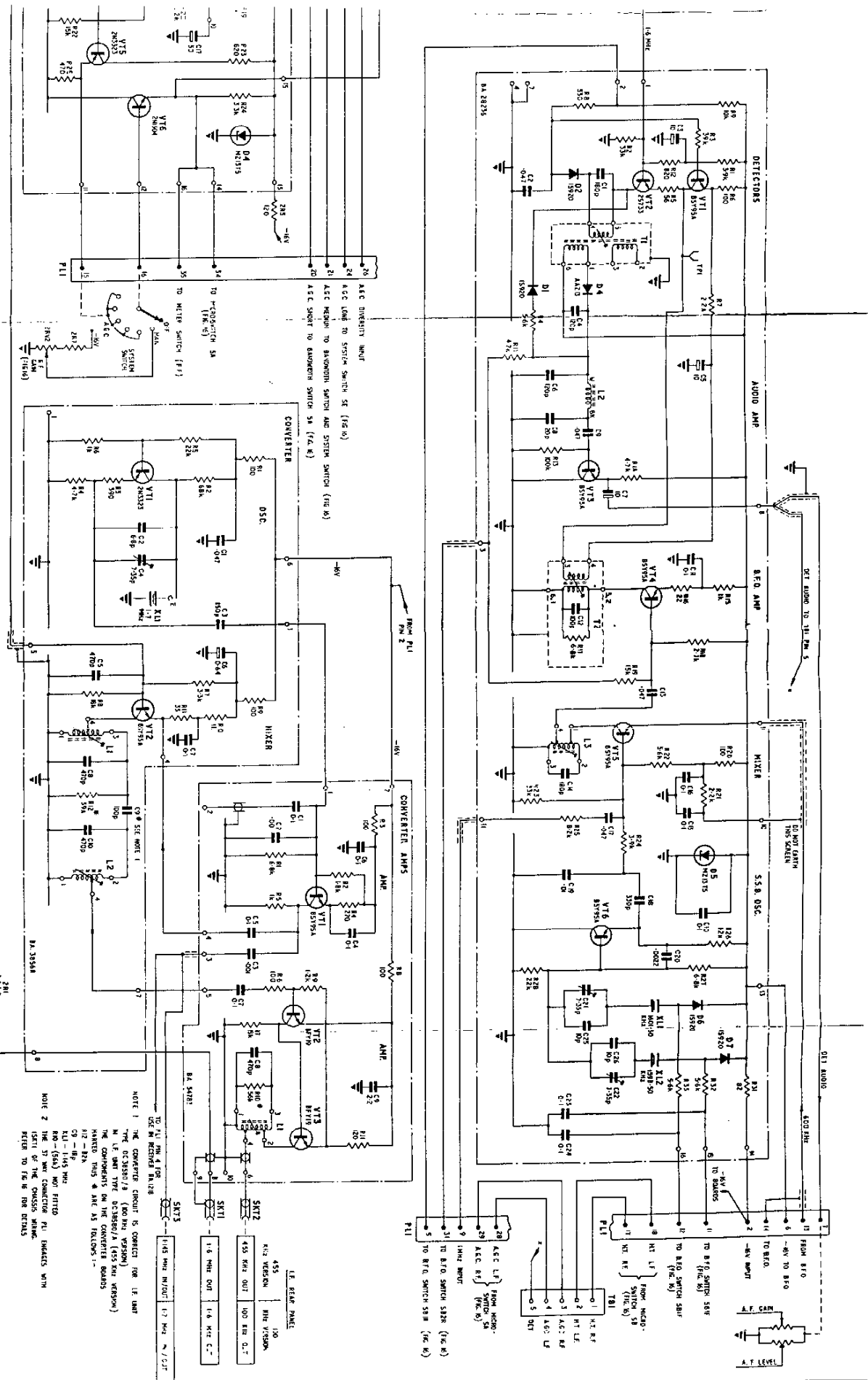


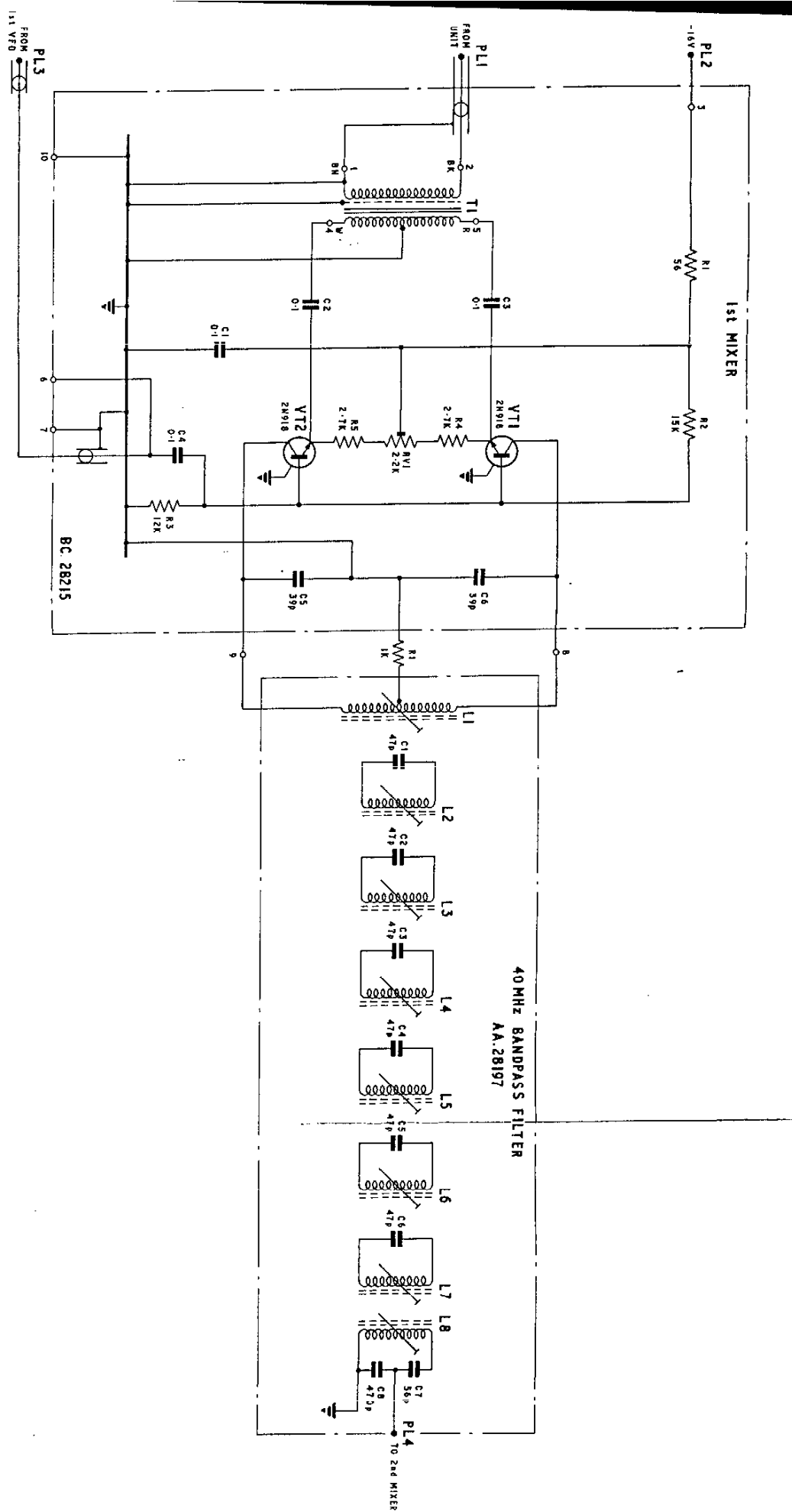
Fig.12

Fig. 15(a)

BC 30640	261/15
1	



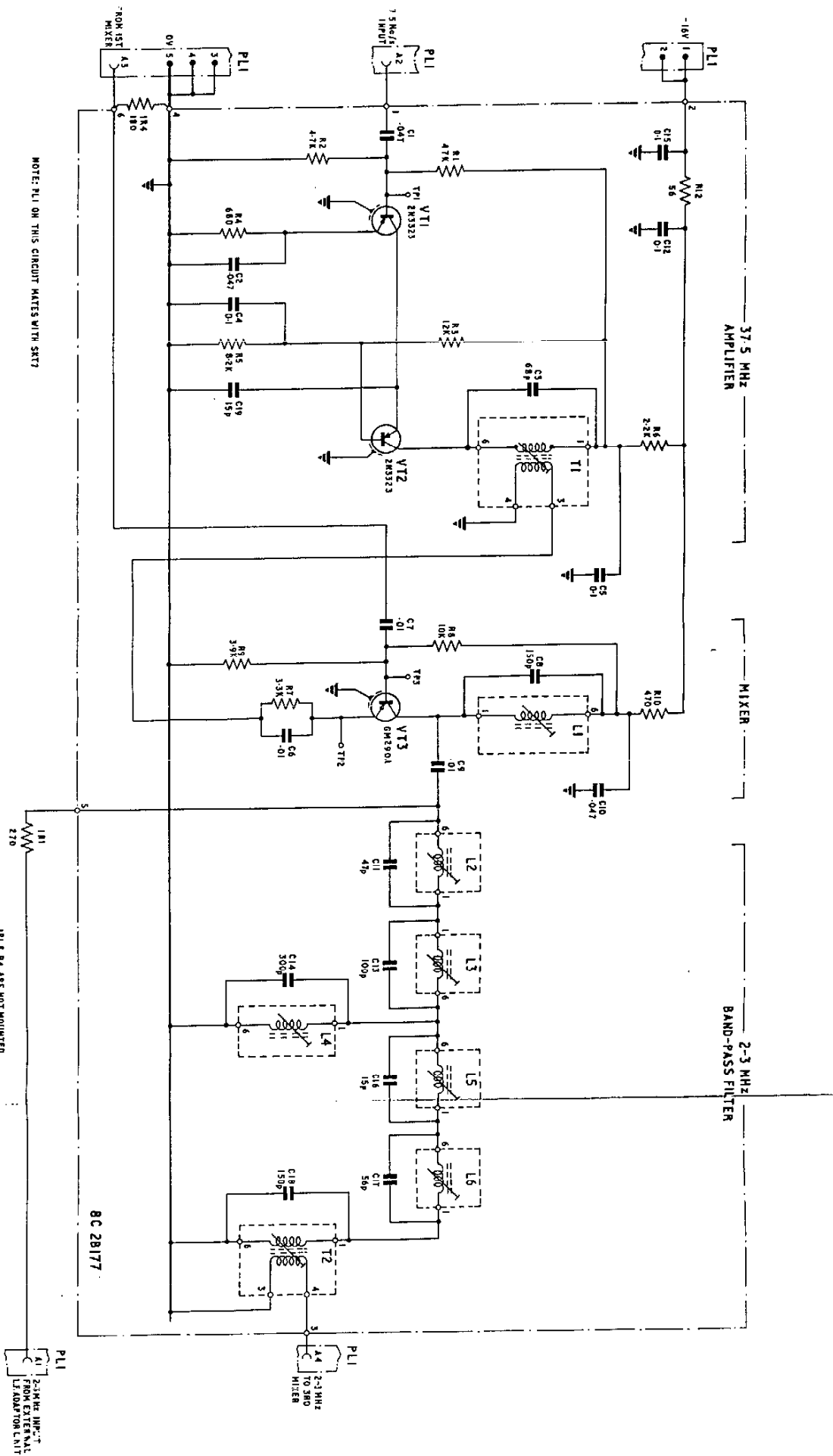




8-28211	281/8
2	4

Circuit : 1st Mixer and 40MHz. Filter

Fig. 8



Circuit: 2nd Mixer

Circuit : 2nd V.F.O.

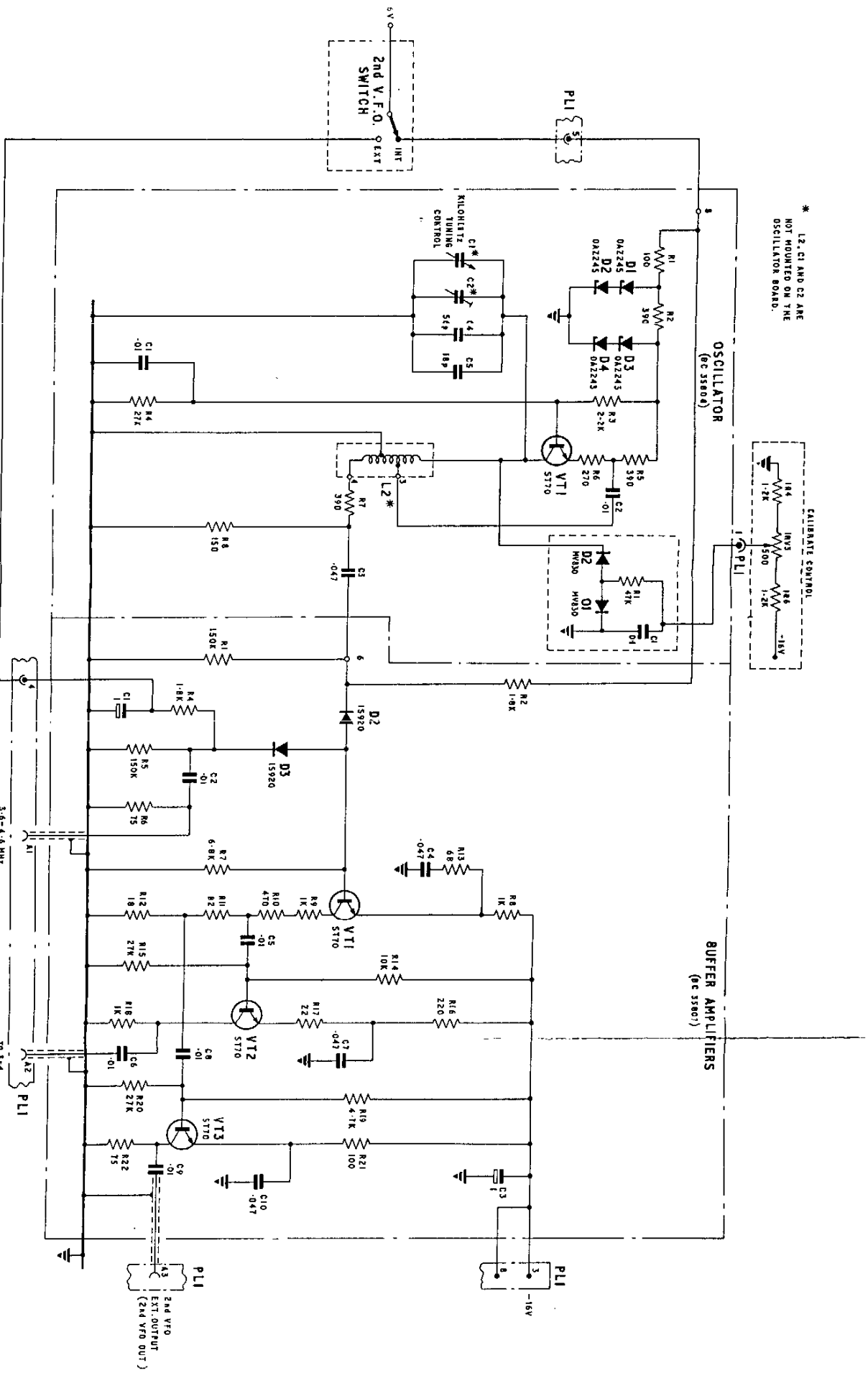
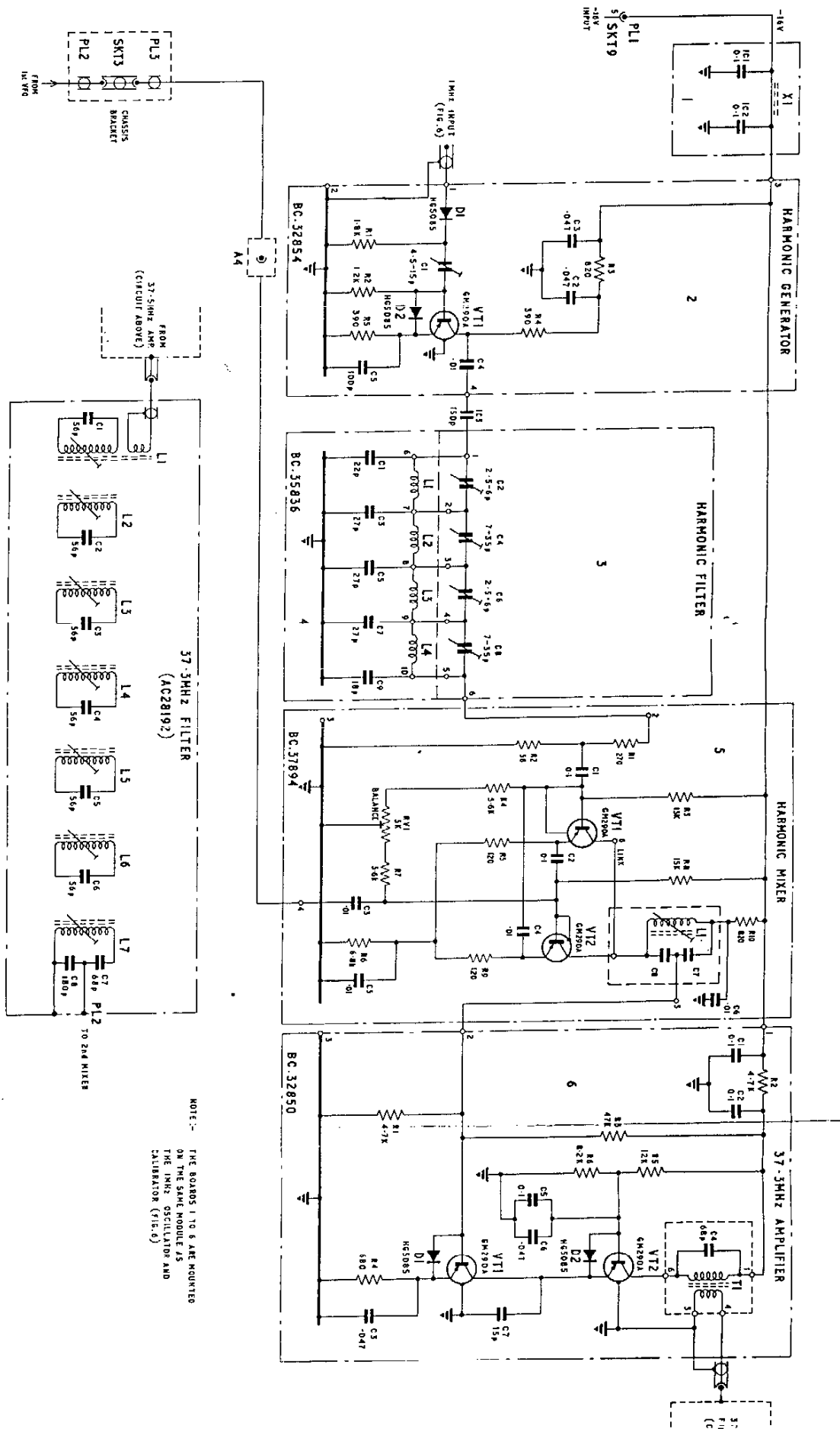
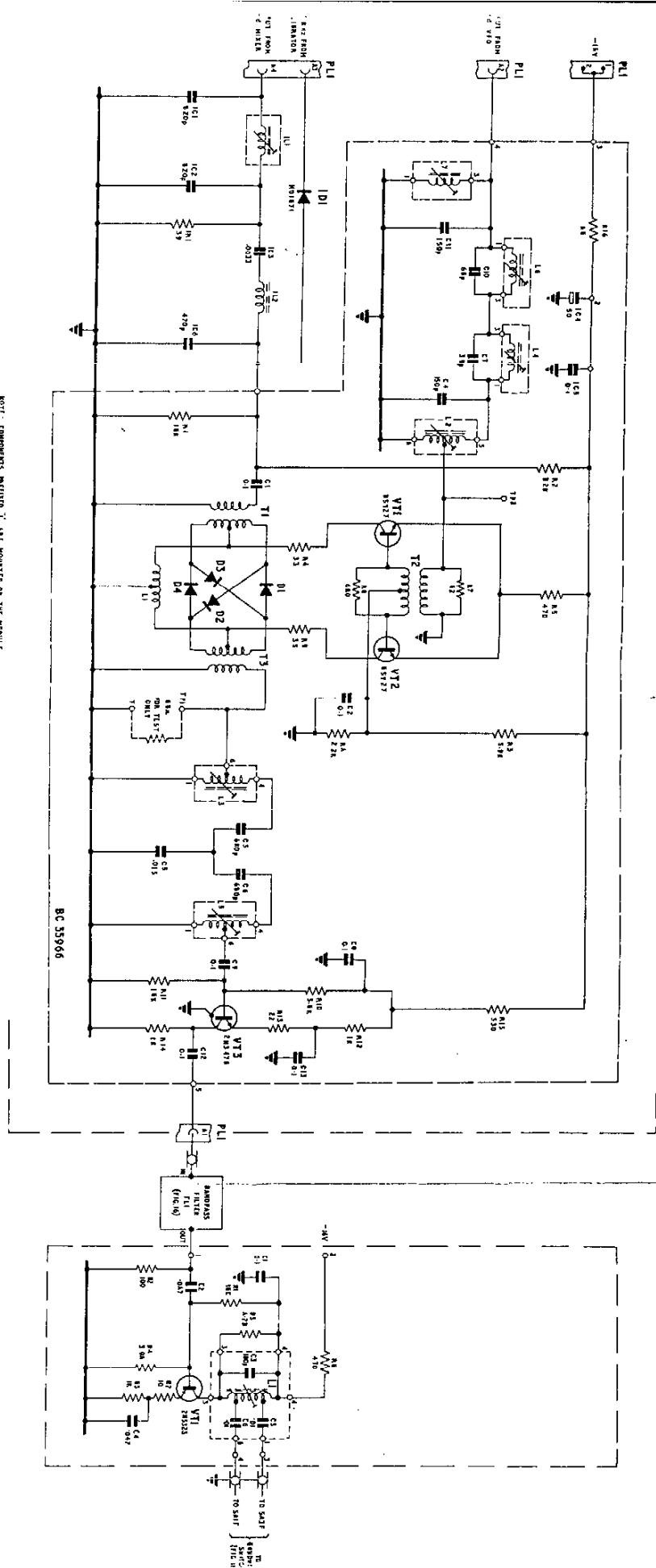


Fig.10

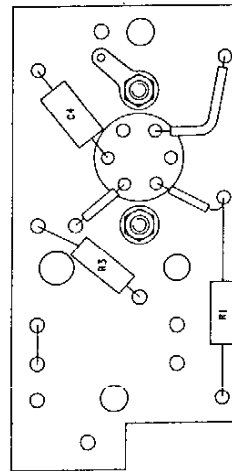
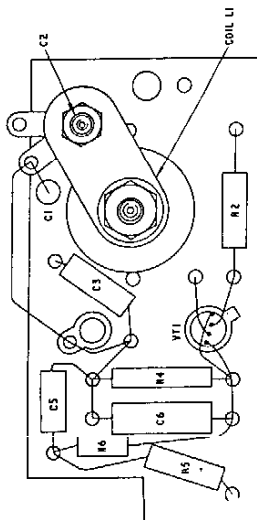


Circuits: Harmonic Generator Mixer and 37.5MHz Filter  
(37.5MHz Generator)

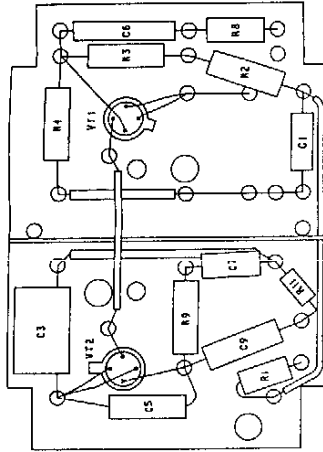
1	BC28334/8	2N/J
3	AC28192	



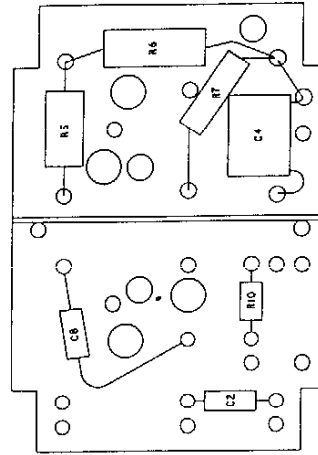
Circuit : 3rd Mixer Module and 1st I.F. Amplifier Unit



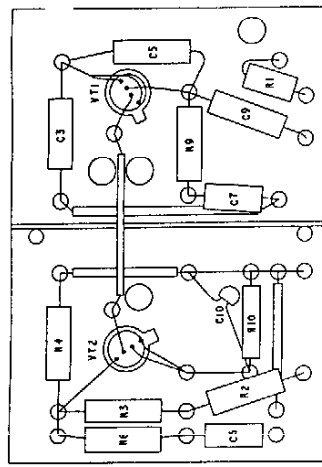
OSCILLATOR  
(BA. 35195)



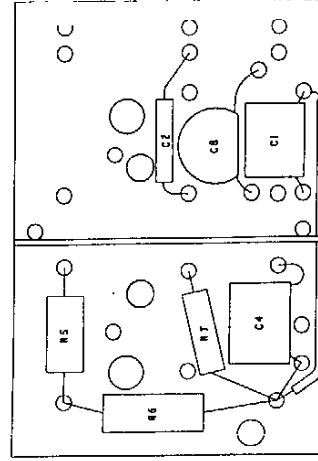
NOTE: THIS BOARD IS CONTAINED IN THE  
RECTANGULAR BOX



BUFER AMPLIFIER  
(BC. 32535)



NOTE: THIS BOARD IS ATTACHED TO THE UNDERSIDE  
OF THE 1st. VFO CHASSIS



BUFER AMPLIFIER  
(BC. 28128)

Fig. L-5

Component Layouts 1st. VFO

RA.1217

LIST OF ILLUSTRATIONS

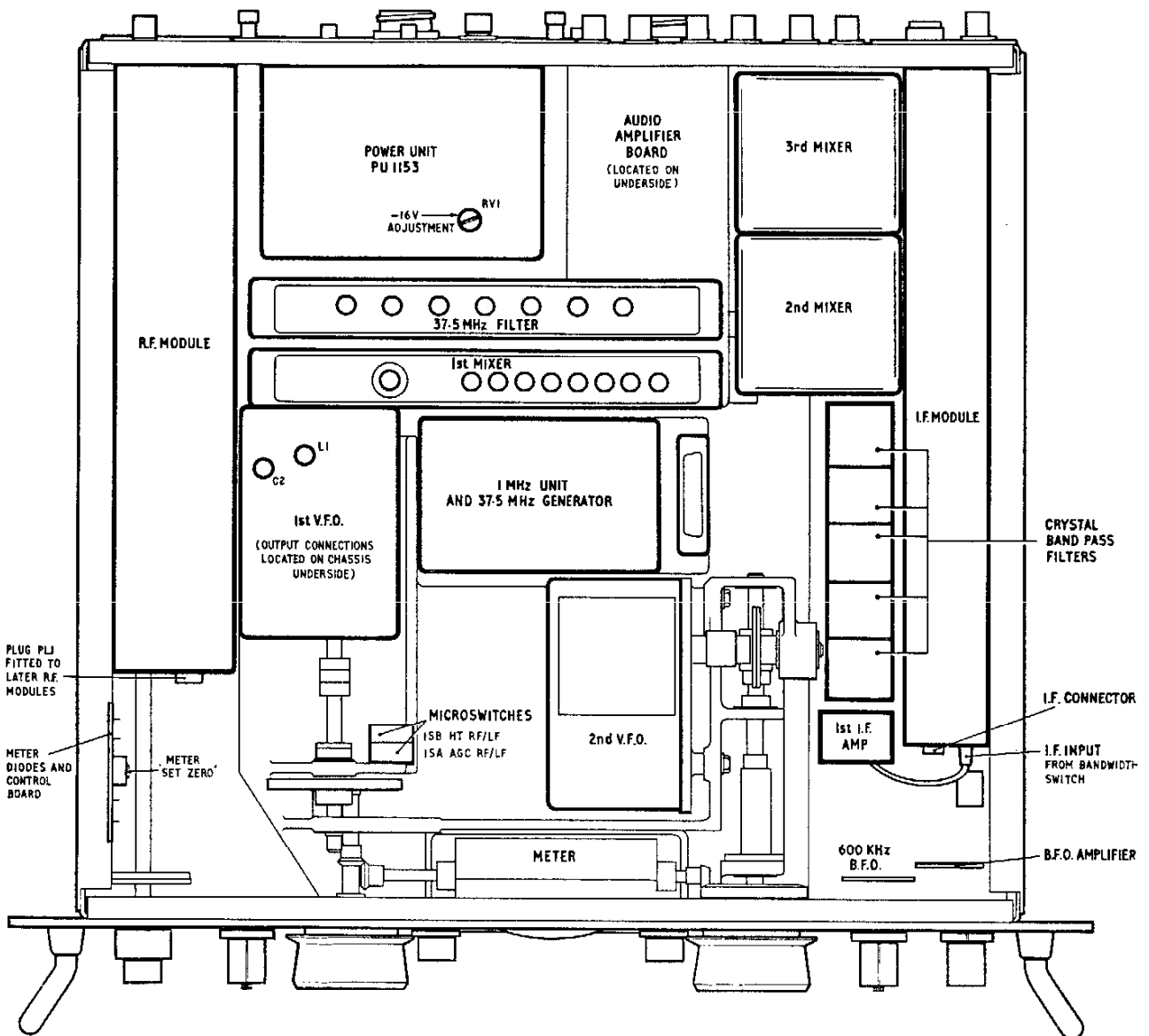
Frontispiece      H.F. Communications Receiver RA.1217

Fig. No.

At Rear of Book

- |        |  |
|--------|--|
| 1      | Wadley System - Block Diagram                          |
| 2      | Electronic Band Selection: Explanatory Block Diagram   |
| 3      | Block Diagram: RA.1217                                 |
| 4      | Circuit: R.F. Module                                   |
| 5      | Circuit: 1st V.F.O.                                    |
| 6      | Circuit: 1 MHz Amplifiers. Oscillator and Calibrator   |
| 7      | Circuit: Harmonic Generator, Mixer and 37.5 MHz Filter |
| 8      | Circuit: 1st Mixer and 40 MHz Filter                   |
| 9      | Circuit: 2nd Mixer                                     |
| 10     | Circuit: 2nd V.F.O.                                    |
| 11     | Circuit: 3rd Mixer                                     |
| 12     | Circuit: I.F. Module                                   |
| 13     | Circuit: B.F.O. Unit                                   |
| 14     | Circuit: Audio Amplifier                               |
| 15 (a) | Circuit: Power Unit PU.1153                            |
| 16     | Interconnections: RA.1217                              |
| 17     | Interconnecting Diagram : 16 volt Supplies RA.1217     |
| 18     | Chassis Upperside : RA.1217                            |
| 19     | Rear Panel : RA.1217                                   |

APPENDICES

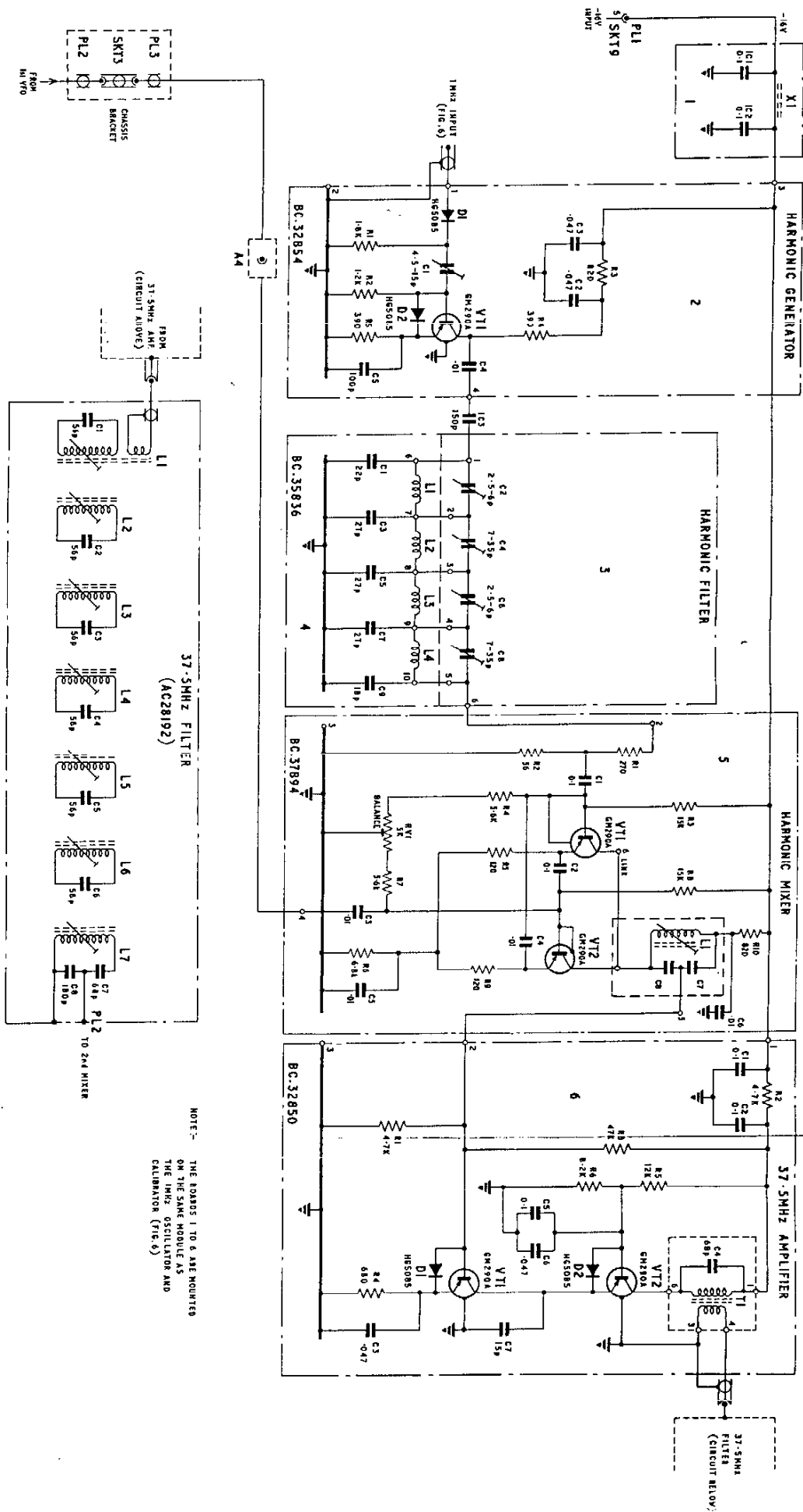


281/18

Chassis Upperside RA 1217

Fig.18





Circuits: Harmonic Generator Mixer and 37.5MHz Filter  
(37.5MHz Generator)

Fig. 7

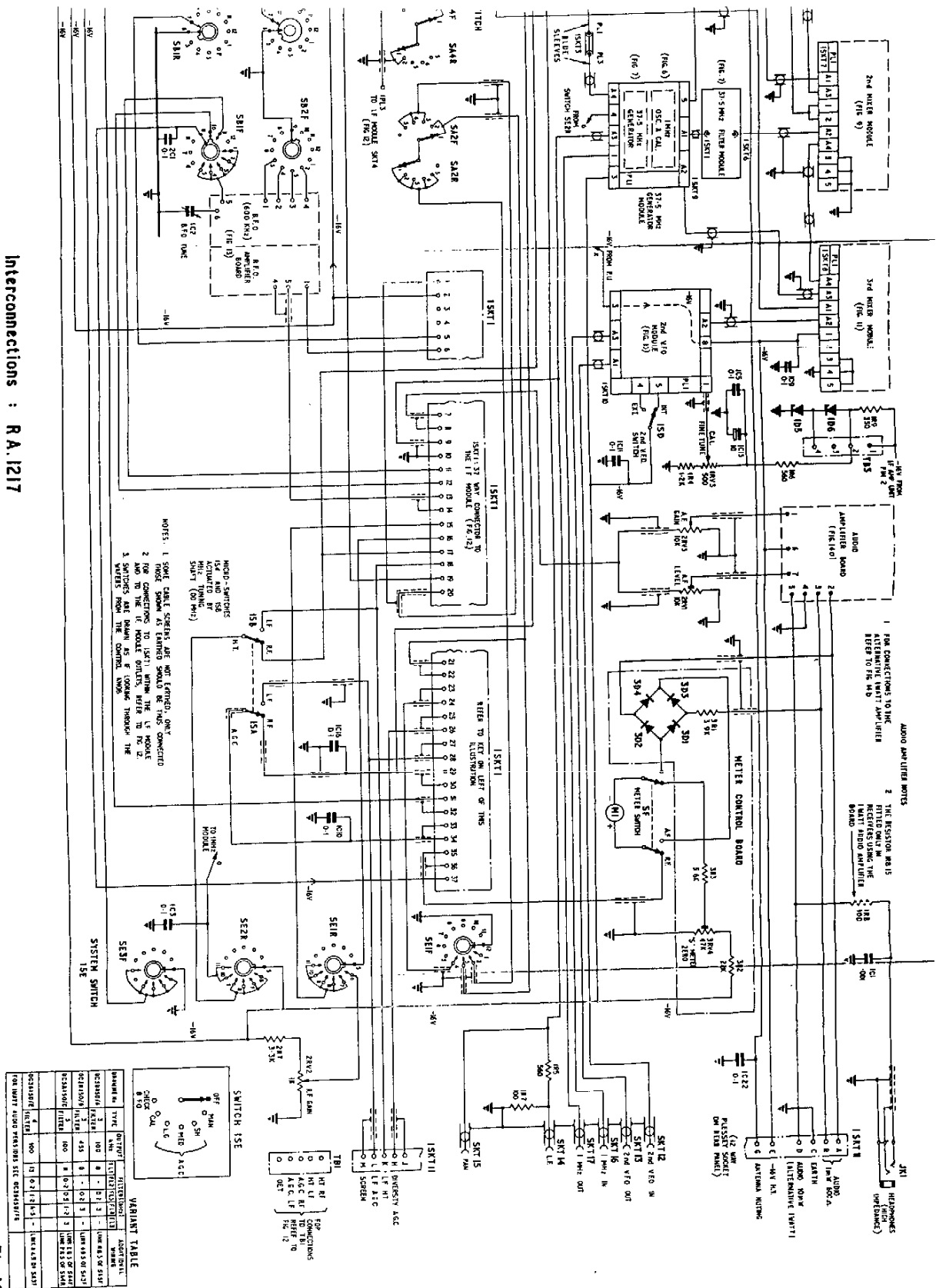


**Fig. 17**

201517

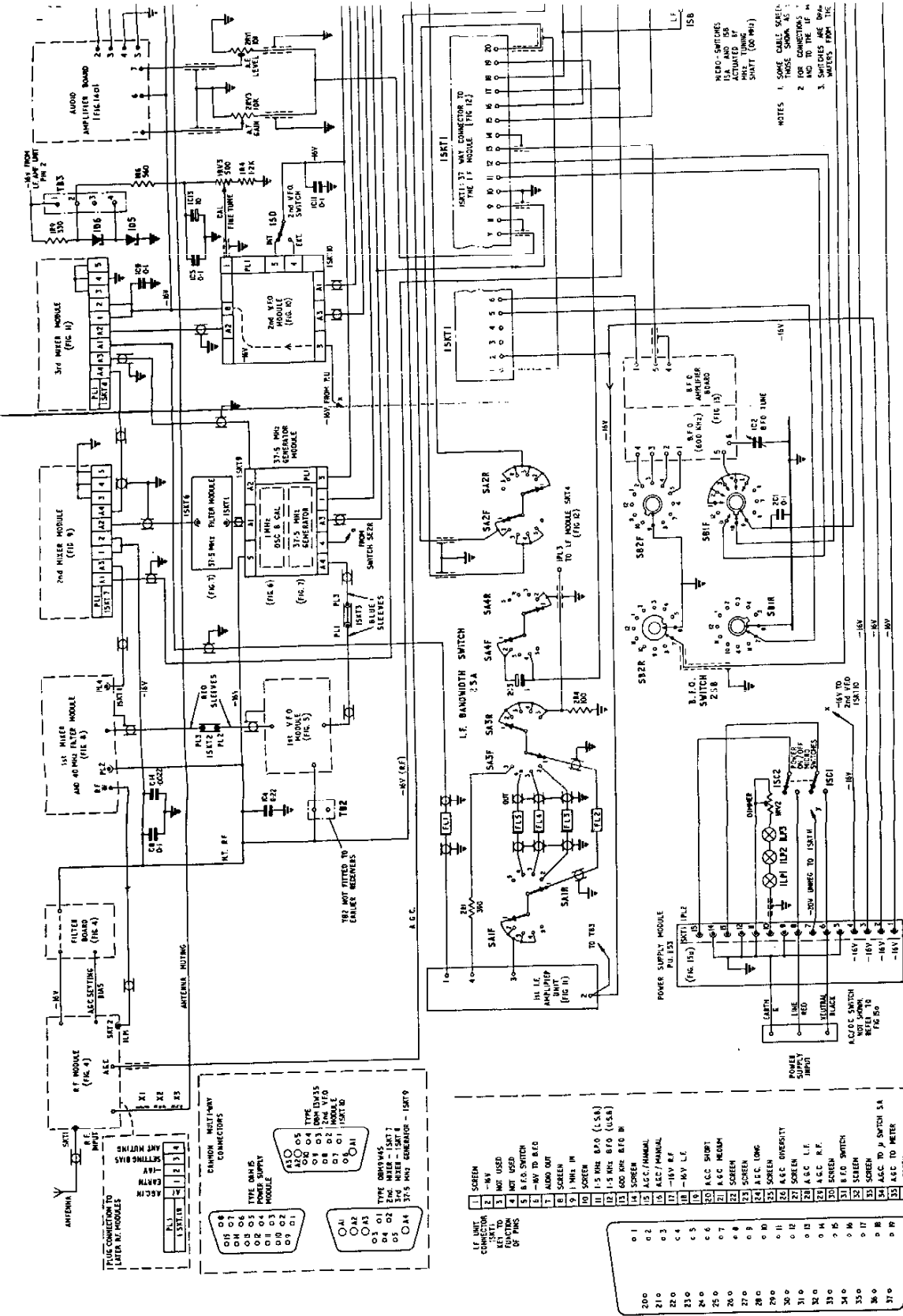
NOTES

1. DE-COUPLING CAPACITORS ARE NOT SHOWN ON THIS ILLUSTRATION : REFER TO FIG 10.
2. REFER TO FIG 16 FOR RESISTOR VALUES

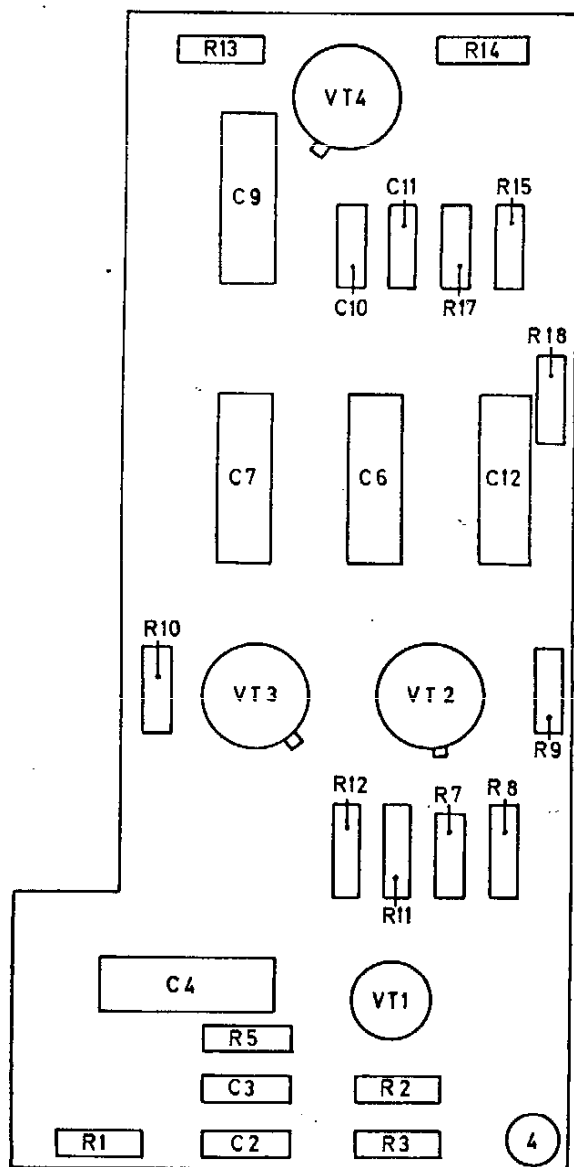


Interconnections : R.A.1217

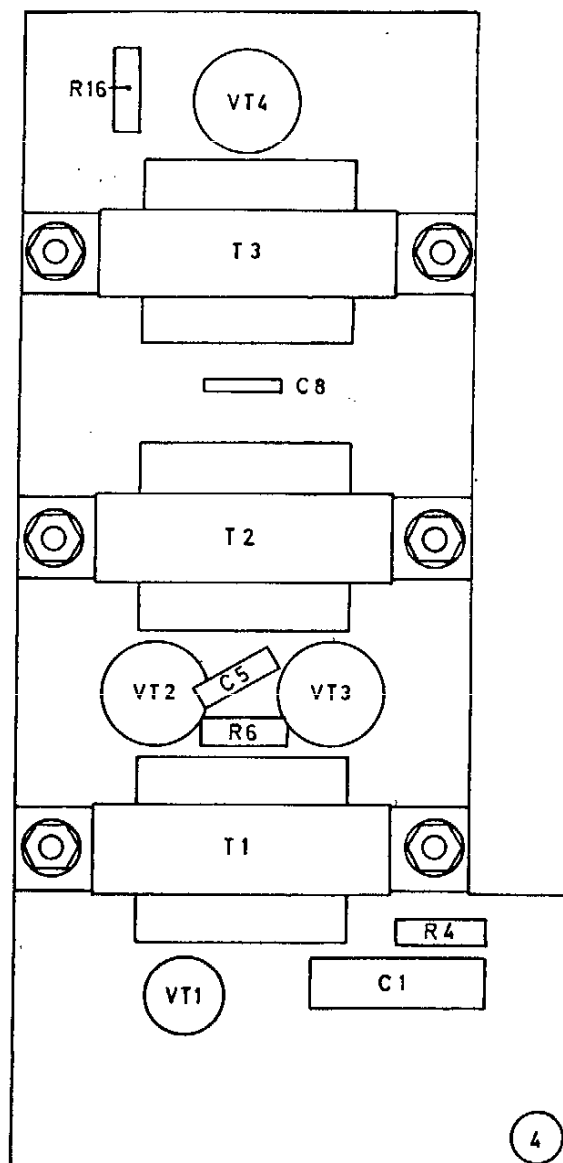
Fig.16



Interconnections : R.A.1217



FRONT



REAR

Fig. L-14a

Component Layout  
10mW Audio Amplifier Board

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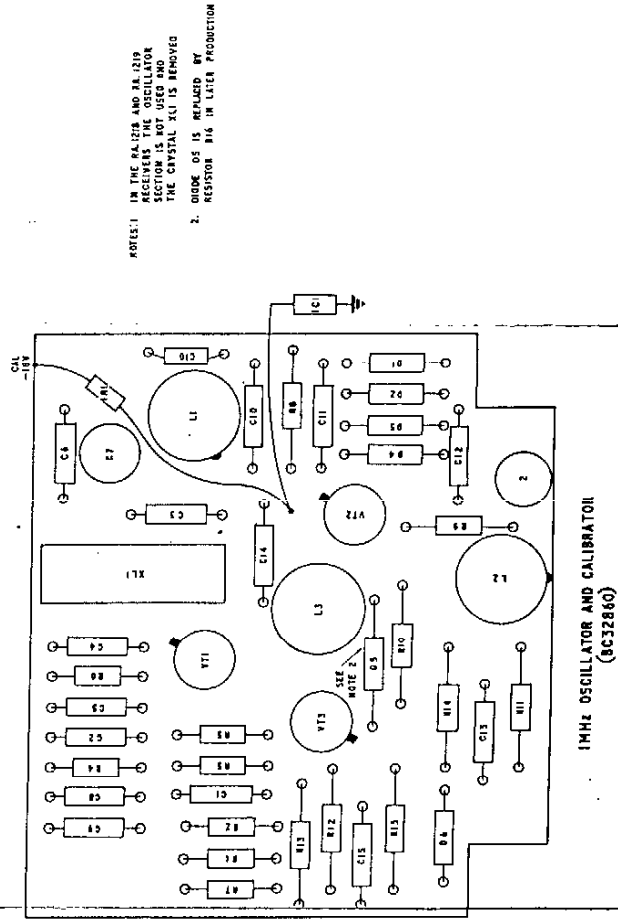
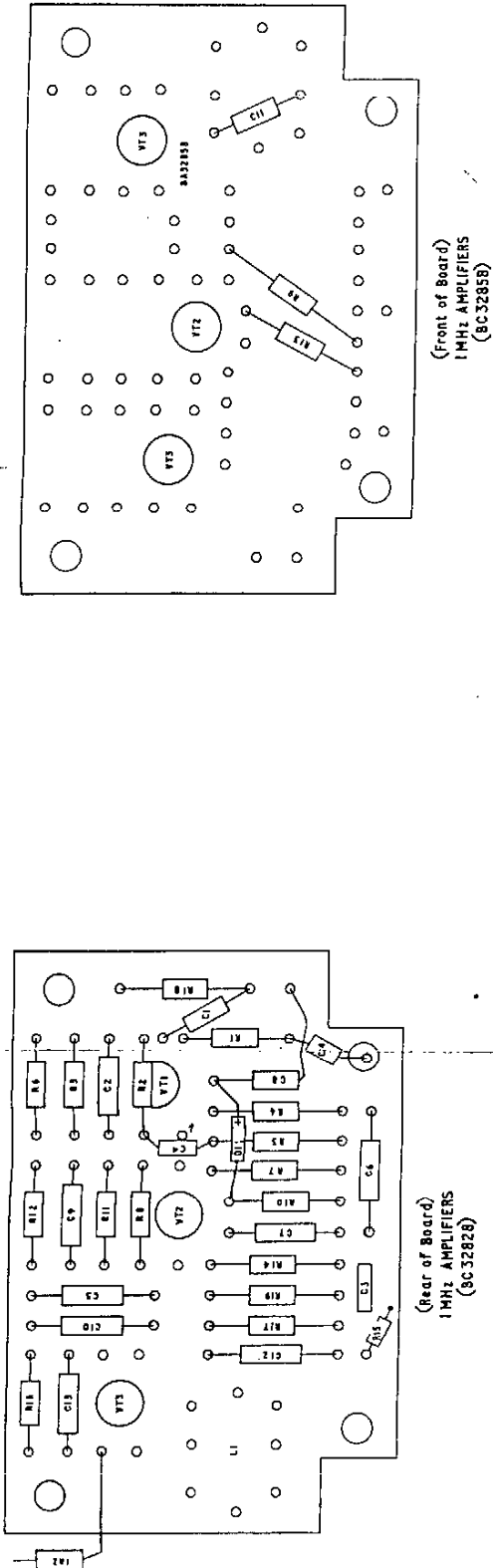
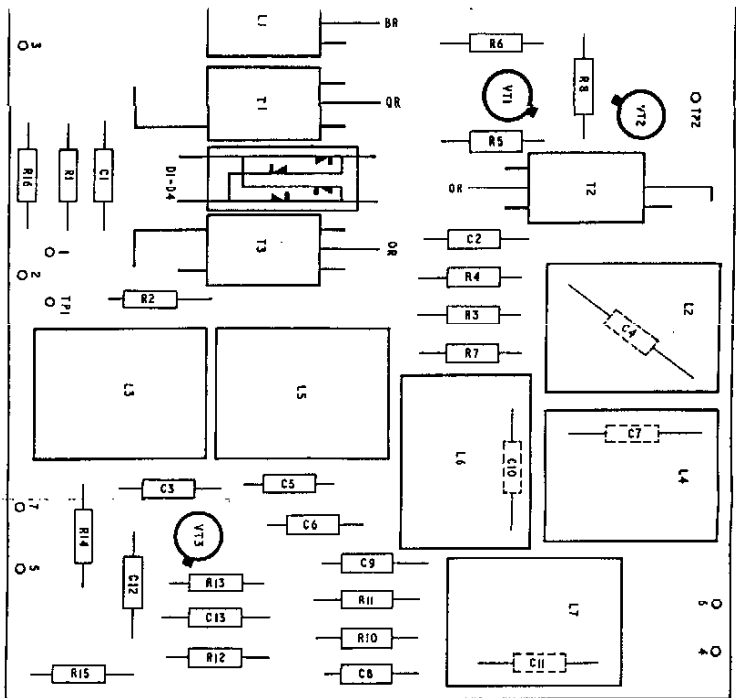


Fig. L-6

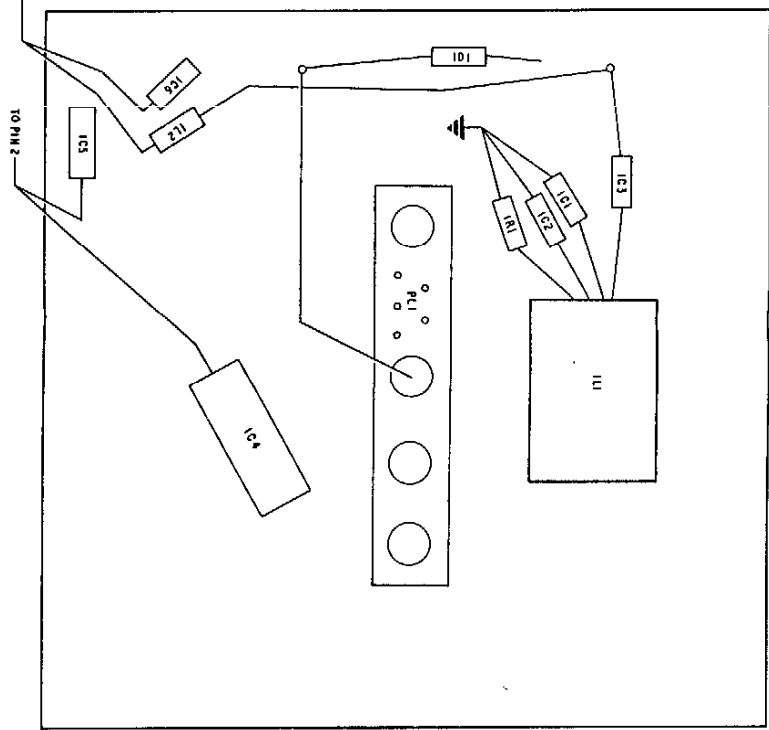
Layout: 1MHz Amp. Oscillator and Calibrator

180/172

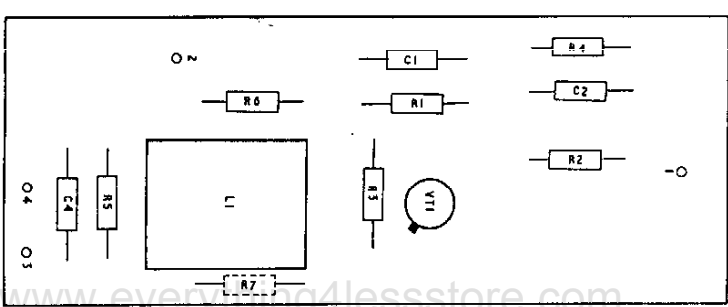


NOTE: C4, C7, C10, C11  
ARE WIRED ON REAR OF BOARD

3rd MIXER MODULE



1st I.F. AMPLIFIER UNIT

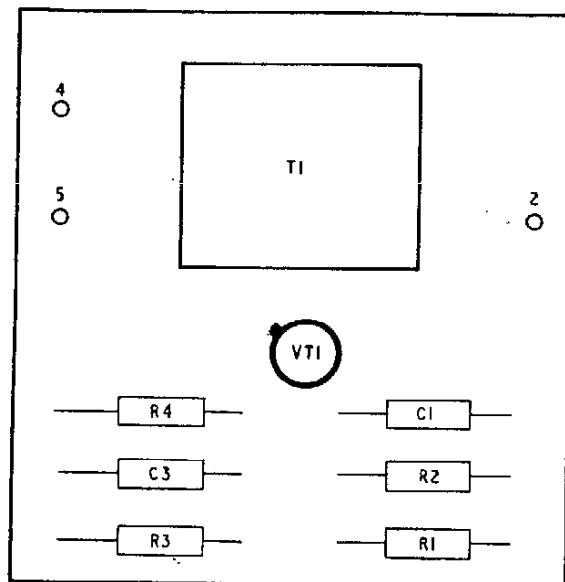


Component Layout: 3rd Mixer Module and 1st I.F. Amplifier Unit

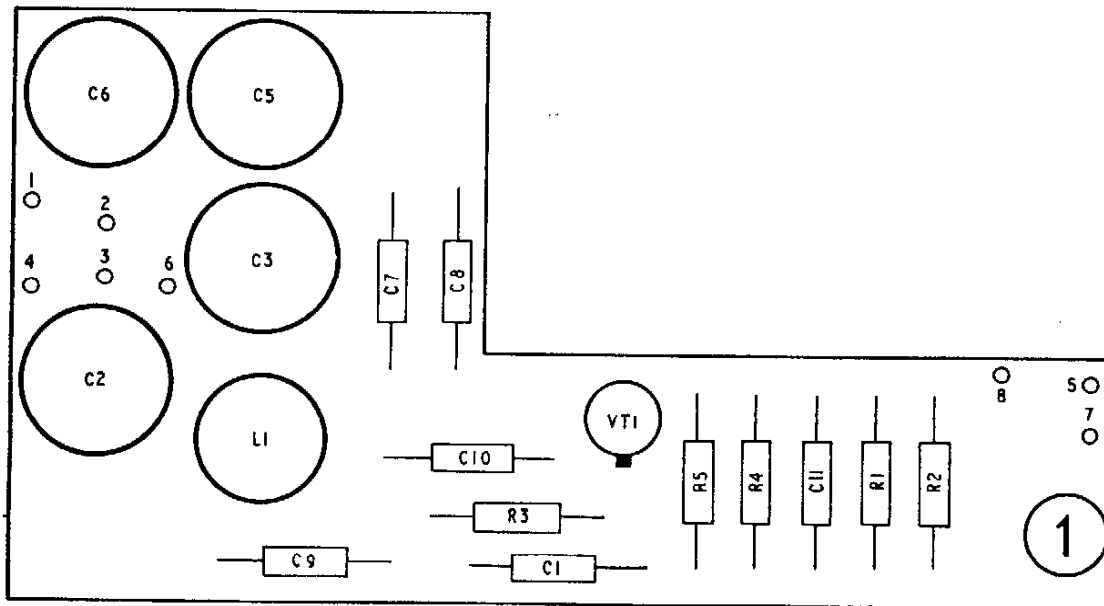


**Component Layout: Audio Amplifier Board  
(1 Watt)**





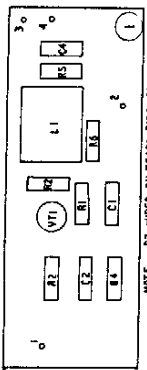
B.F.O. Amplifier  
(B.C.30542)



600KHz Oscillator  
(B.C.30540)

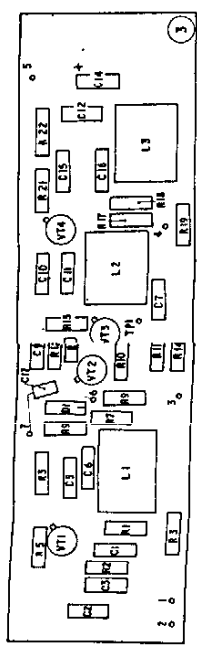
Fig.L-13

Component Layout B.F.O.

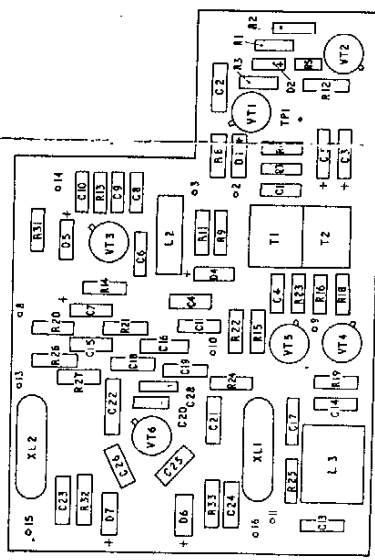


NOTE: R7 WIRED ON TRACK SIDE OF BOARD

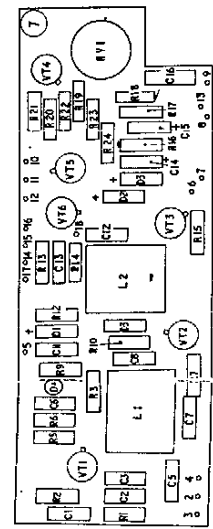
1ST IF AMPLIFIER BOARD



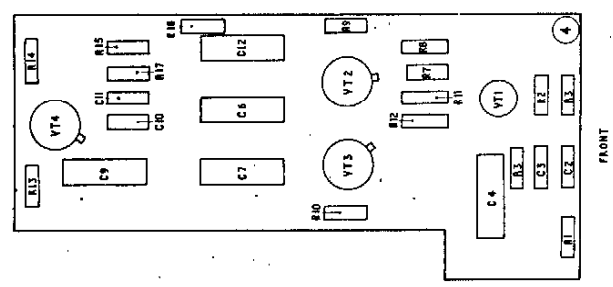
MAIN IF AMPLIFIER BOARD



DETECTOR BOARD



AGC BOARD



AUDIO AMPLIFIER

Component Layout: IF Unit  
(6c2825)

Fig. L-12

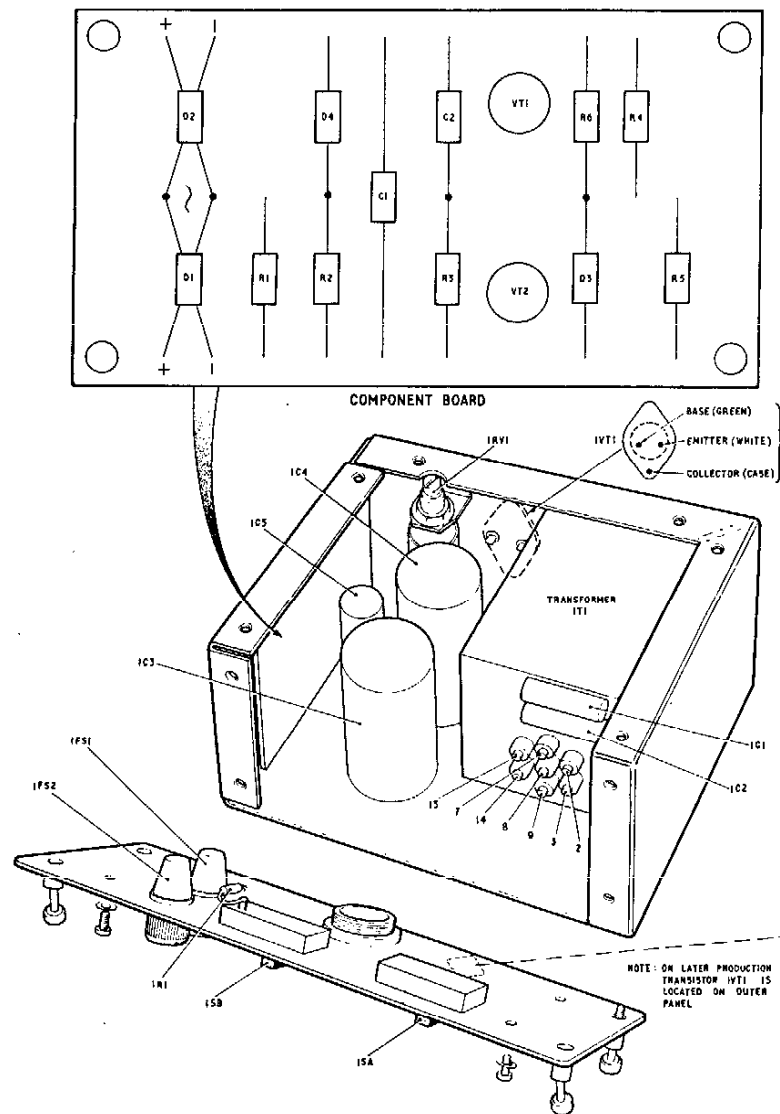
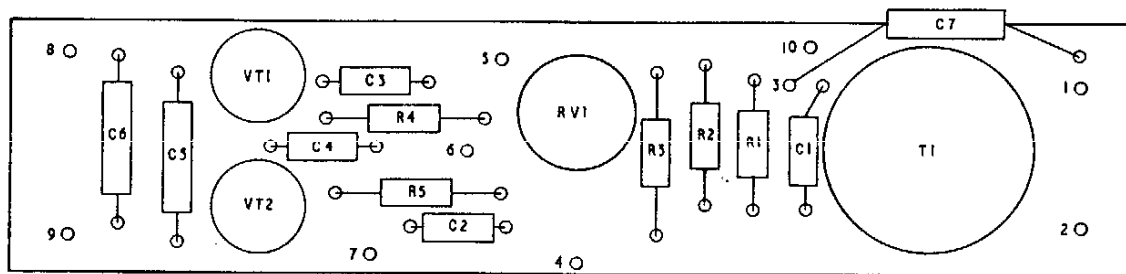


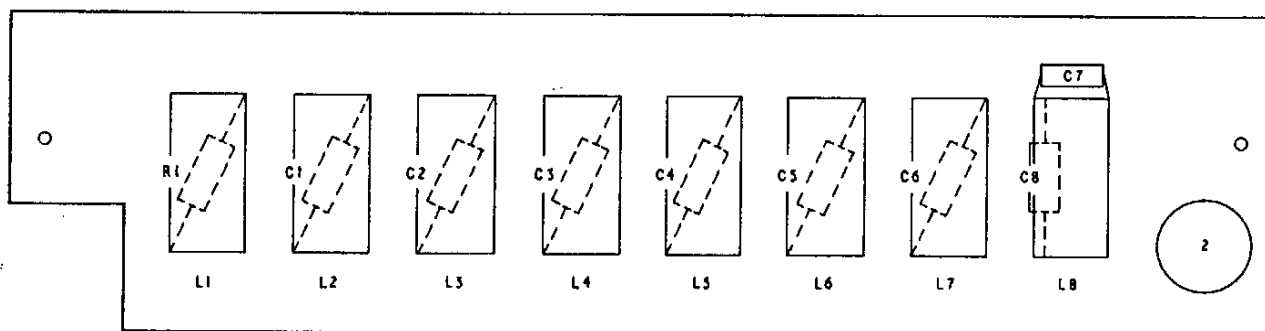
Fig. L-15a

Layout: Power Unit Type PU.1153

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1st MIXER  
(BC.2B215)

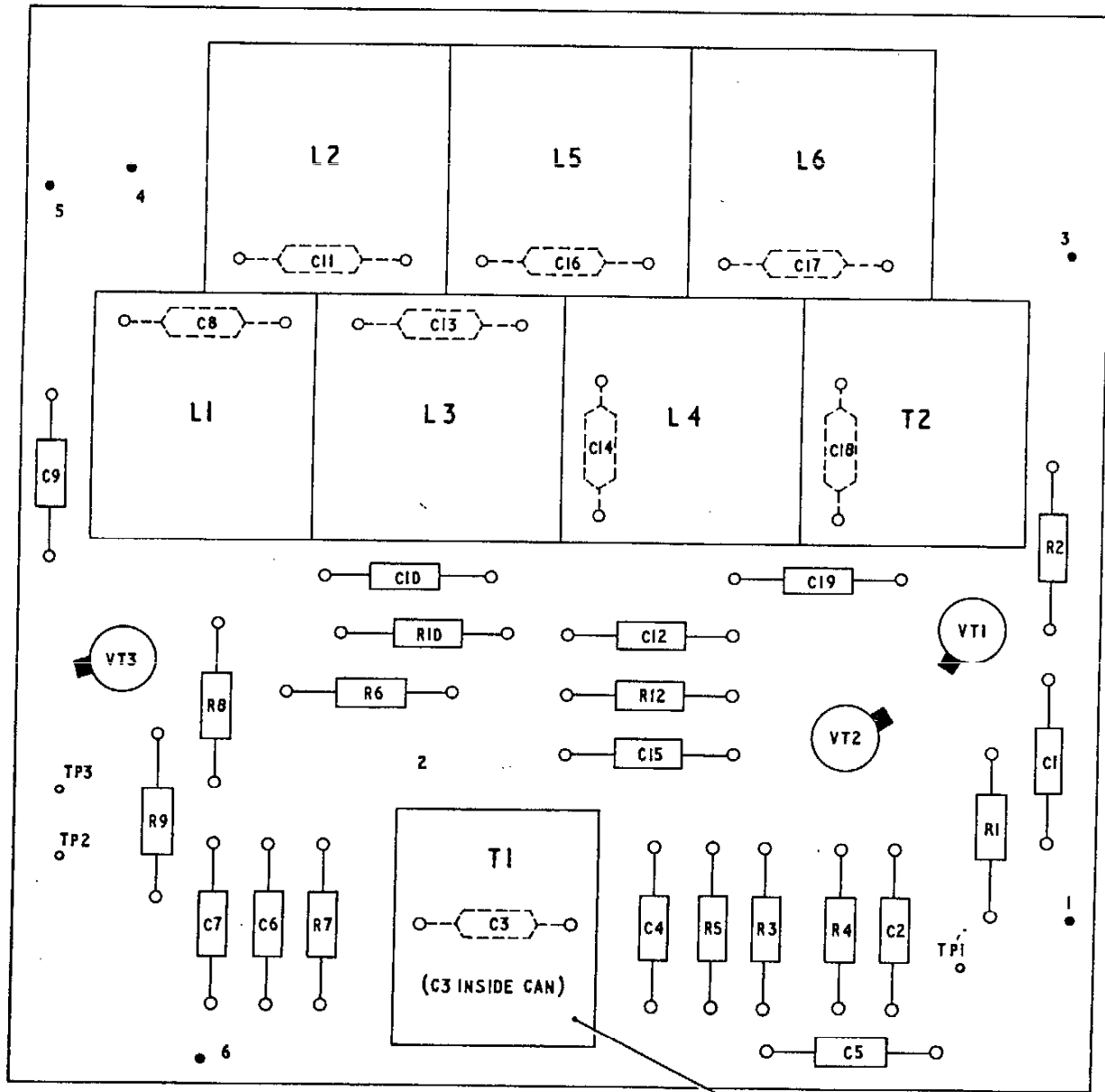


40 MHz FILTER  
(AC.2B197)

Fig. L-8 Component Layout: 1st Mixer and 40 MHz Filter

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NOTE: CAPACITORS C8, C11, C13, C14, C17 AND C18 ARE WIRED ON REAR OF BOARD



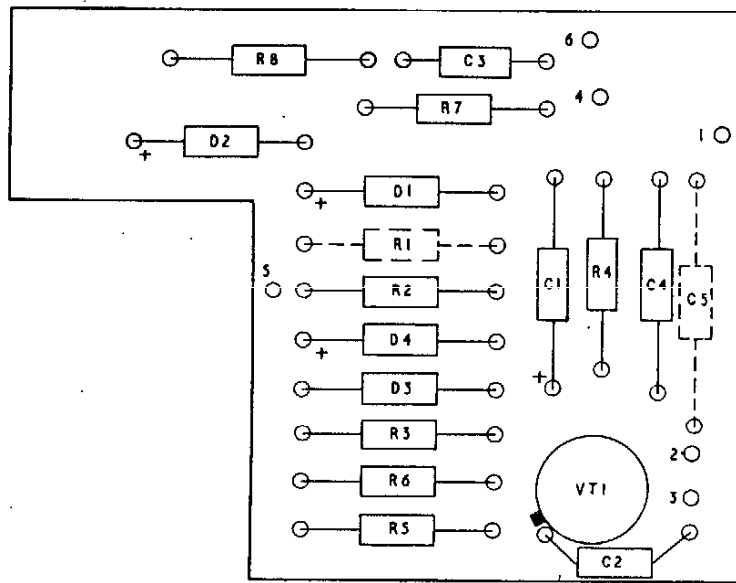
2nd. MIXER  
BC. 28177

NOTE:  
A BLUE SPOT ON T1 INDICATES  
THAT C3 IS WIRED ON THE TRACK  
SIDE OF THE BOARD.

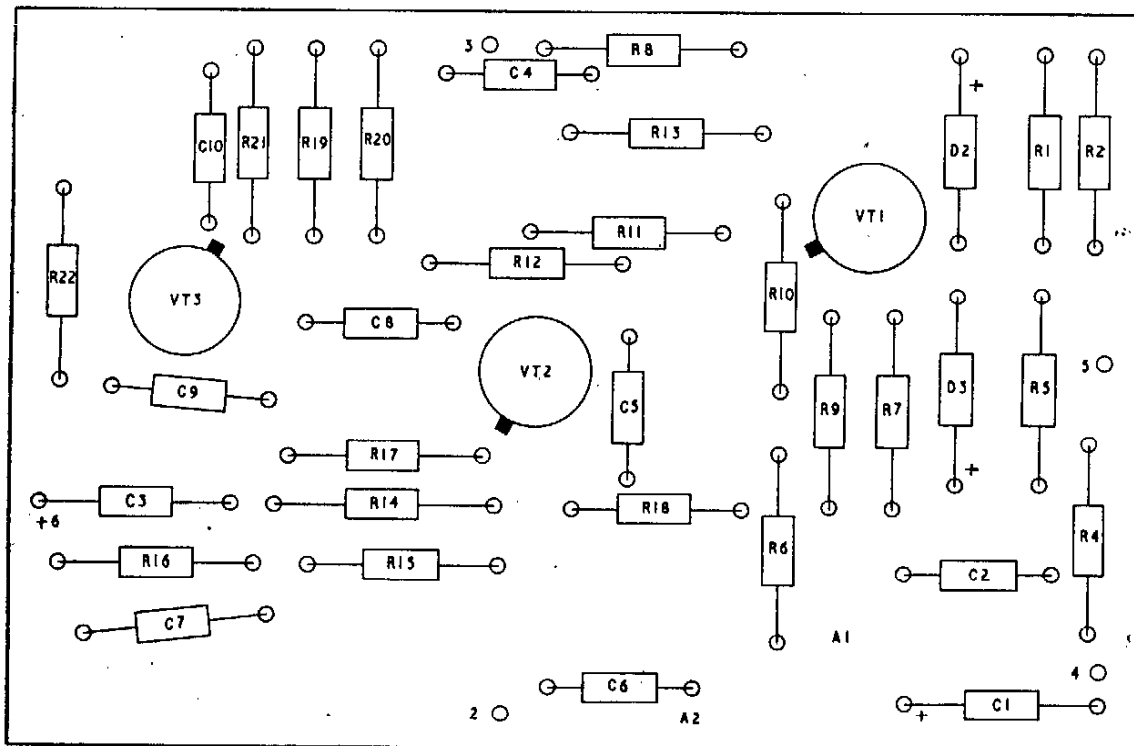
Fig. L-9

Component Layout : 2nd Mixer

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OSCILLATOR BOARD  
(BC.35808)



AMPLIFIER BOARD  
(BC.35807)

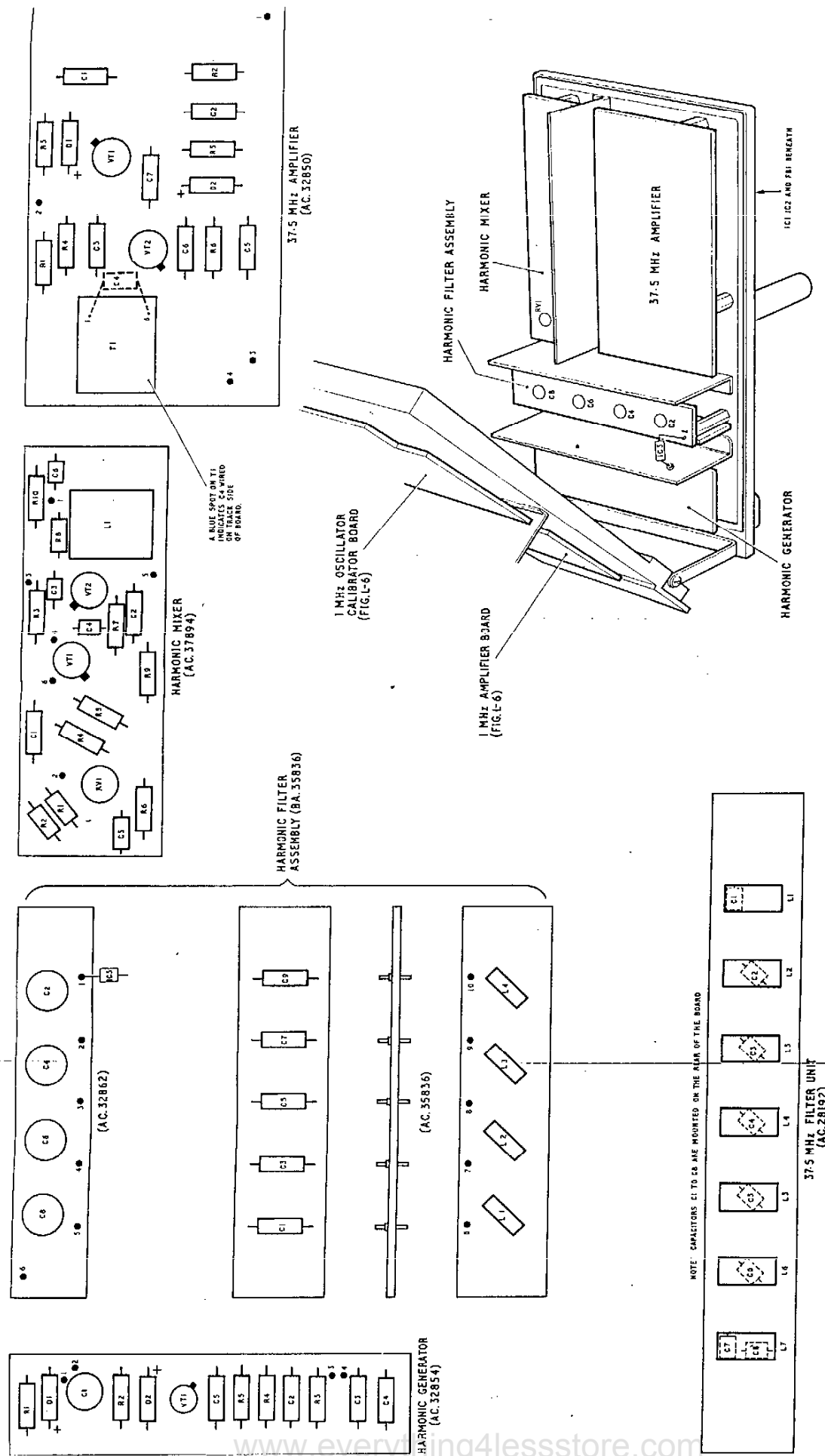


Fig. L-7

Component Layouts: 37.5 MHz Generator and 37.5 MHz Filter Unit

20/1/23

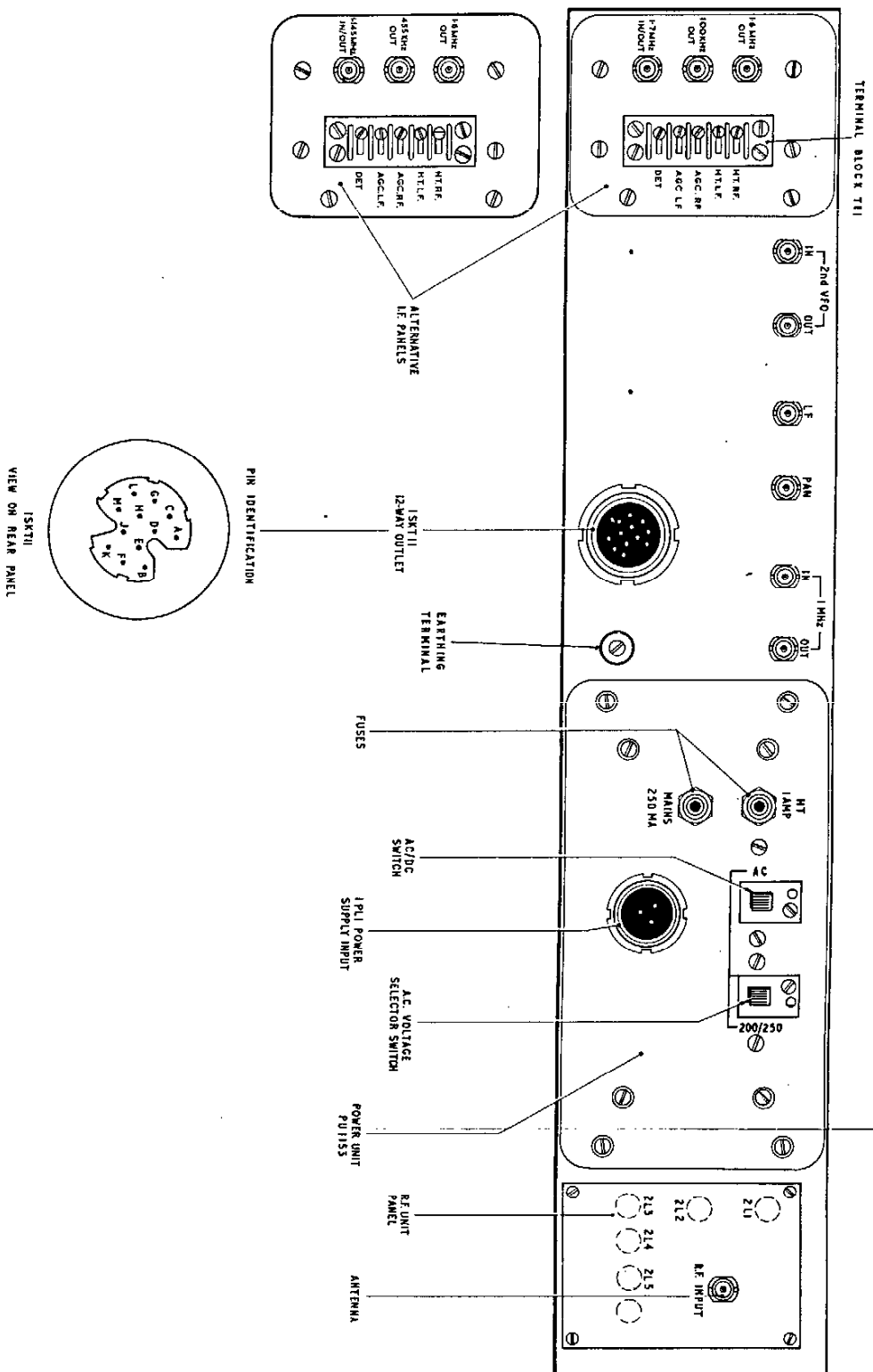
NOTE: The screened and coaxial cables carry numbered marker sleeves.

Wire Number	Type or Colour	From	To	Wire Number	Type or Colour	From	To
1	Coaxial	SKT12	SKT10 (A1)	41	Violet (orange sleeve)	Audio Amp. (6)	SKT9 (1/2)
2	Coaxial	SKT13	SKT10 (A3)	42	Violet (orange sleeve)	SKT8 (1/2)	SKT10 (8)
3	Coaxial	SKT15	SKT7 (A1)	43	Violet (yellow sleeve)	PL2 (4)	SKT10 (3)
4	Coaxial	SKT16	SKT9 (1)	44	Violet	Control Board (R2)	SE2R (5)
5	Coaxial	SKT17	SKT9 (A3)	45	Violet	ISD	SE2R (5)
6	Coaxial	SKT17	SKT1 (9)	46	Violet	ISD	R7
7	Coaxial	SKT7 (A4)	SKT8 (A4)	47	Violet	R7	SKT9 (3)
8	Coaxial	SKT8 (A1)	FL1	48	Violet (blue sleeve)	SKT9/5	H. T. Filter Board
9	Coaxial	SKT8 (A3)	SKT9 (A2)	49	Violet	SKT9/5	SKT1 (17)
10	Coaxial	SKT8 (A2)	SKT10 (A3)	50	Violet (red sleeve)	SKT1/2	1st I. F. Amp. (2)
11	Coaxial	SKT7 (A3)	SKT4	51	Violet (red sleeve)	1st I. F. Amp. (2)	PL2 (2)
12	Coaxial	SKT7 (A2)	SKT6	52	Violet (black sleeve)	SE2R (10/11)	SKT9 (4)
13	Coaxial	SKT9 (A1)	SKT1	53	Violet (blue sleeve)	ISB	SKT1 (17)
14	Coaxial	SKT9 (A4)	PL3	54	Violet	SKT9 (3)	PL2 (1)
15	Screened	ISA	SKT1 (29)	55	Black/Orange	SE1R (5)	SKT1 (16)
16	Screened	REF. AGC	ISA	56	Black/Green	SE1R (6)	2RV2
17	Screened	ISA	SKT1 (28)	57	Green/Grey	ISB	SE2R (6-9)
18	Screened	ISA	SKT11 (L)	58	Black/White	SKT1 (15)	SE1R (7-11)
19	Screened	SKT1 (26)	SKT11 (H)	59	Grey/White	SE3F	SB1F (9)
20	Screened	SKT1 (24)	SE1F (4)	60	Blue/Orange	Control Board D3-D4	Meter Switch SF
21	Screened	SKT1 (34)	ISA	61	Not Used		
22	Screened	SKT11 (21)	SA2F (1/2)	62	Red/Blue	Control Board D1-D2	Meter Switch SF
23	Screened	SA2F 1/2	SE1F (3)	63	Blue/White	Control Board (R3)	ISB
24	Coaxial	SA2R 1-5	SE1F (2)	64	Blue/White	SKT11 (K)	SKT1 (18)
25	Screened	SA2F 1-3	SKT1 (20)	65	Blue/White	ISB	ISD
26	Screened	SF (RF)	SKT1 (35)	66	Red/Green	SKT10 (5)	ISD
27	Screened	ILP1	ILP2	67	Green/White	SKT10 (4)	ISD
28	Screened	ILP1	ILP3	68	Green/Blue	SKT10 (1)	IRV3 (Slider)
29	Screened	IRV2	PL2	69	Red/White	SKT11 (G)	R. F. Module
30	Screened	ILP2	PL2 (10)	70	Violet (white sleeve)	SKT11 (E)	Audio Amp. (6)
31	Screened	2RV3	Audio Amp. (1)	71	Red/Orange	SKT1 (5)	SB1R (7)
32	Screened	2RV1	Audio Amp. (7)	72	Green/Blue	SKT1 (6)	B. F. O. Amp. (1)
33	Screened	JK1	R8	73	Blue	SKT1 (11)	SB1F (11)
34	Screened	IT1	Control Board	74	Orange	SKT1 (12)	SB1F (10)
35	Screened	SKT1 (7)	2RV1	75	Red/Blue	R. F. Module -16V	H. T. Filter Board (C1)
36	Screened	SKT1 (13)	B. F. O. Amp. (5)	76	Green	R. F. Module	H. T. Filter Board 4RV1
37	Screened	SKT1 (31)	SB2R (7)	77	Brown/Grey	PL2 (7)	SKT11 (F)
38	Violet (red sleeve)	1st I. F. Amp. (2)	R6	78	Violet (blue sleeve)	SKT7 (1/2)	H. T. Filter Board.
39	Violet (orange sleeve)	SKT1 (37)	PL2 (3)	79	Screened	IRV2	ILP3
40	Not Used.			80	Brown/Grey	SA4F4	SKT1 (19)

Fig. L-16

Interconnections: Main Cableform





Rear Panel, RA1217

Fig. 19

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## REPAIR DATA

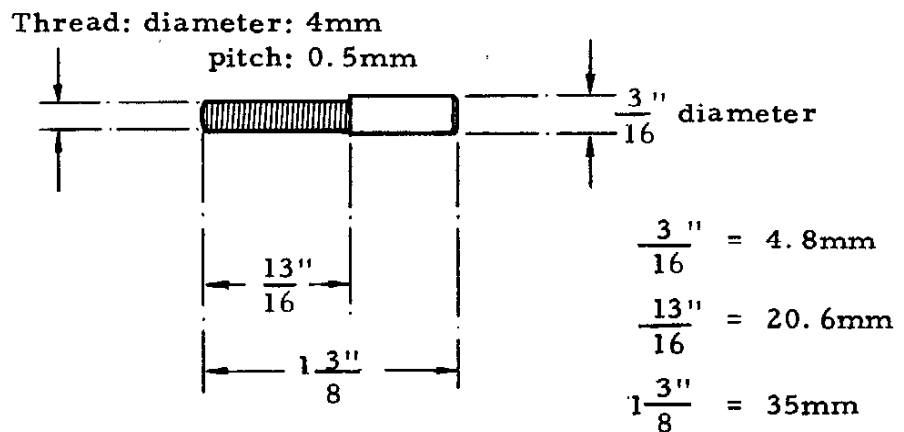
### IMPORTANT NOTICE

1. When soldering certain types of coil assembly to the printed circuit board, the heat can cause serious distortion of the coil former. The types of coil most liable to this distortion are those wound on a "Neosid" former, and the following precautions must be observed with these particular coils. The procedure is recommended for all coil soldering

- (1) Remove the adjustable core from the replacement coil assembly.
- (2) Insert a brass 'dummy core' which acts as a heat shunt during the soldering operation.
- (3) When soldering is completed, remove the brass heat shunt and insert the normal core.

### HEAT SHUNT

2. The illustration below, shows the data required to make a suitable heat shunt for the above operation (4 mm core).



Material: Brass

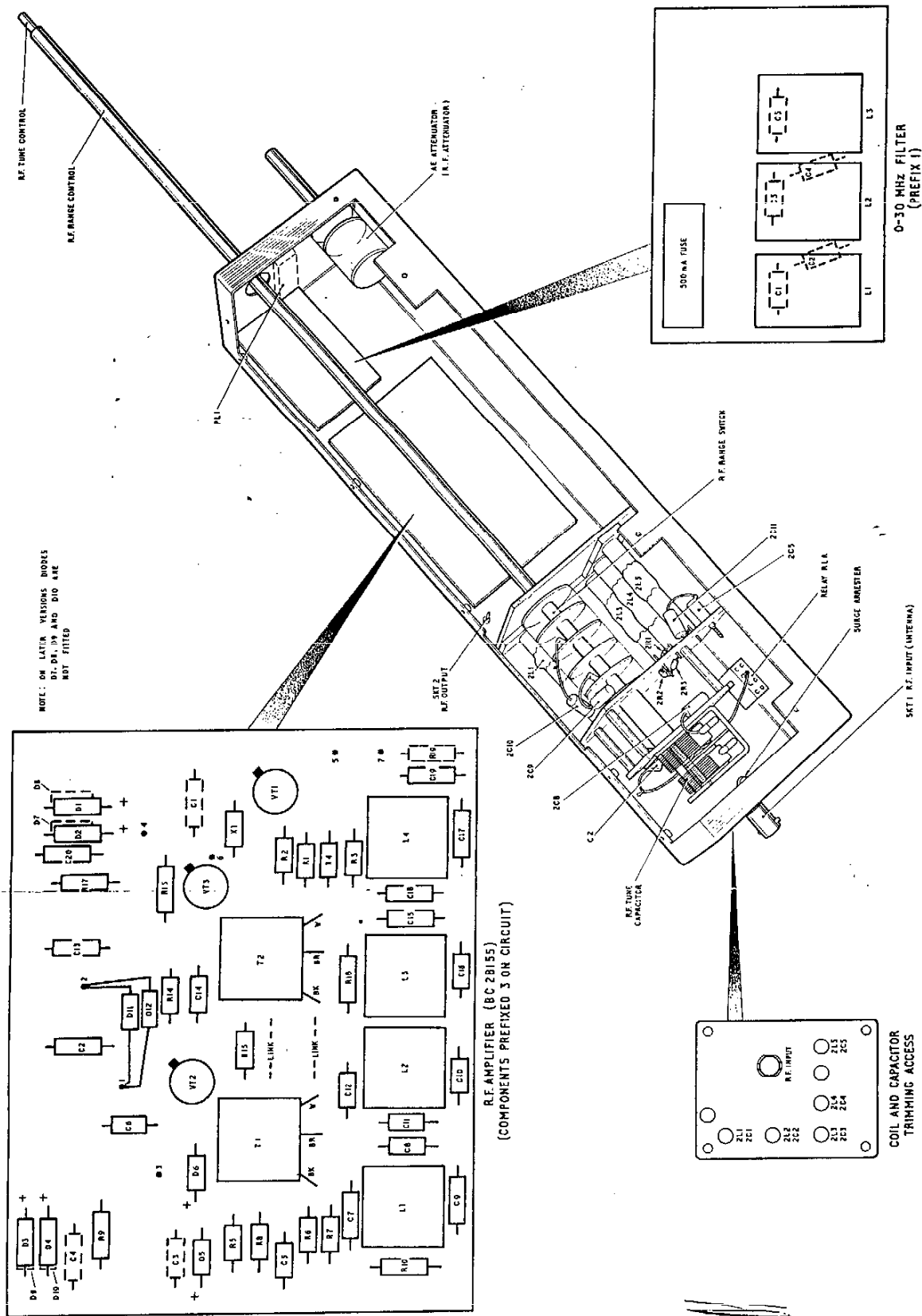
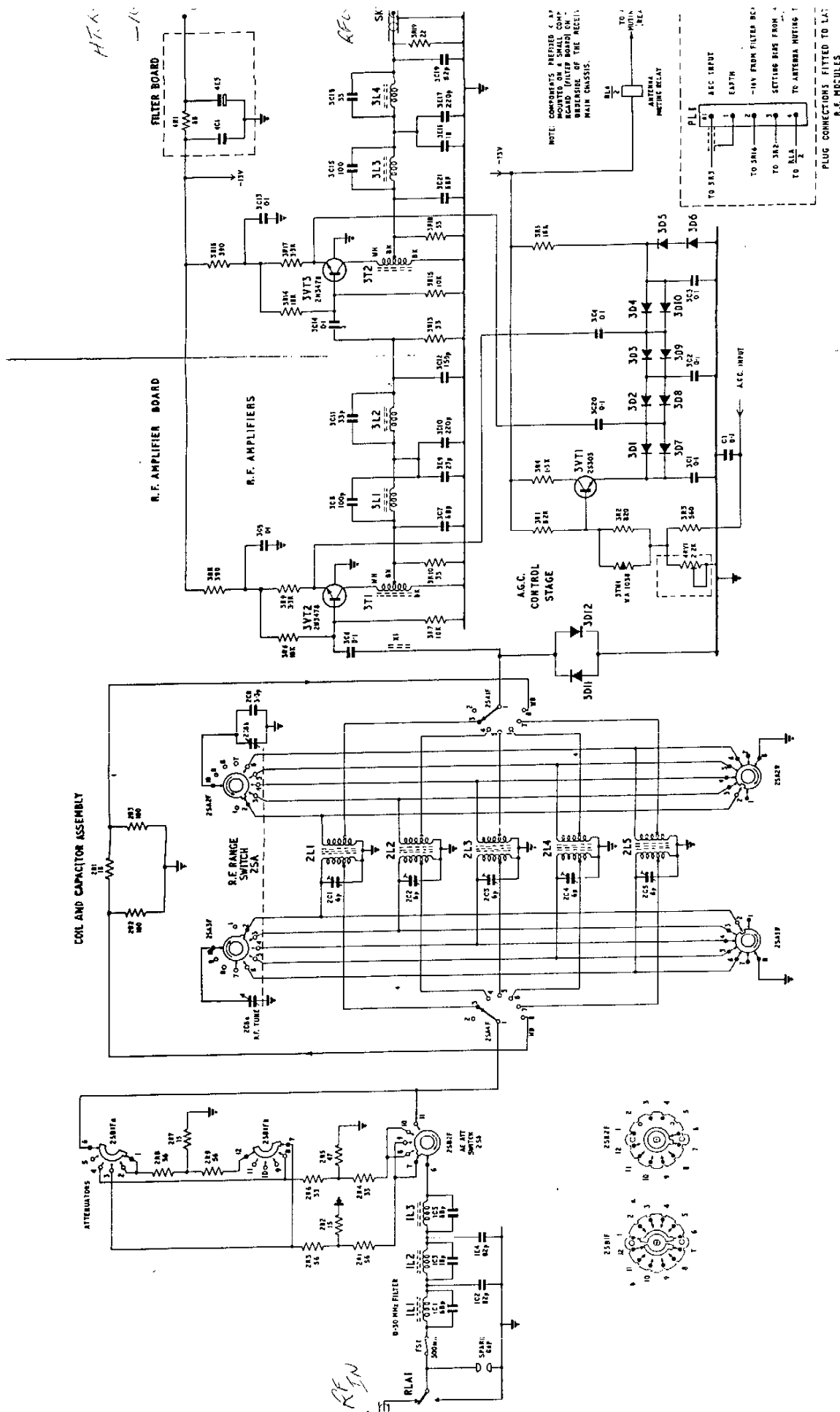


Fig. L-4

Component Layout : R.F. Module.



Circuit: R.F. Module

053533 21/74

## TECHNICAL SPECIFICATION

Frequency Range:	1 to 30 MHz
Modes of Reception:	D.S.B. M.C.W., C.W., S.S.B. (U.S.B. or L.S.B.)
Tuning:	Digital presentation in units of kilohertz / second with interpolation calibration at 200 Hz intervals.
Resetting Accuracy:	±200 Hz
Calibration Accuracy:	±500 Hz (when calibrated to nearest 100 kHz checkpoint)
Calibration:	A 100 kHz signal, derived from the 1 MHz standard crystal oscillator having an accuracy of 5 parts in $10^6$ , provides check points at 100 kHz intervals.
Frequency Stability:	(a) ±50 Hz over an eight hour period at constant ambient temperature and humidity after 2 hours from switching on. (b) Better than 50 Hz per degree Centigrade at constant humidity after 2 hours from switching on.
Antenna Input:	(a) Nominal impedance 75 ohms unbalanced (b) Wideband, or tuned in five automatically selected bands: (i) 1 to 2 MHz (ii) 2 to 4 MHz (iii) 4 to 8 MHz (iv) 8 to 16 MHz (v) 16 to 30 MHz
Sensitivity:	In 3 kHz bandwidth: (a) C.W., S.S.B: 1 µV for 15 dB signal/noise ratio. (b) M.C.W., D.S.B: 30% modulated at 400 Hz: 3 µV for 15 dB signal/noise ratio.

- (m) - -6 volts output
- (n) Diversity A. G. C.
- (o) Muting Contact
- (p) L. F. Adaptor h. t.
- (q) L. F. Adaptor a. g. c.

**Power Supplies:**

Alternative power units are available as follows:

- (a) 100-125 or 200-250V, 45-400 Hz, a. c. single phase; or 21-27V d. c. positive earth.
- (b) 9-15V or 18-30V d. c. positive or negative earth.

**Power Consumption:**

40VA approx. (with one-watt audio amplifier)

**Dimensions:**

<u>High</u>		<u>Wide</u>		<u>Deep</u>
3.5 in.	x	19 in.	x	16½ in.
(8.9 cm)		(48.25 cm)		(41.9 cm)

**Weight:**

31 lb. (14.2 kg) approximately.

**Environmental Conditions:**

The equipment is, designed to meet certain of the requirements of specification DEF 133 L2, operating within the ambient temperature range of:

Storage	- 40°C to + 70°C
Operation	- 5°C to + 55°C

**Construction:**

The unit is of modular construction.

Automatic Gain Control:

(a) Time constants (nominal):

	Charge	Discharge
Short	10 mS	20 mS
Medium	50 mS	250 mS
Long	50 mS	4 S

(b) Output change:

An increase in input of 85dB above 2 microvolts will produce a change in output level of less than 4 dB.

B. F. O:

(a) Variable:  $\pm 3$  kHz centred on +6, +3, 0, -3 and -6kHz with respect to i.f. centre frequency.

(b) Fixed:  $\pm 1.5$  kHz (USB/LSB) crystal controlled.

A. F. Output:

(a) Headphone jack on front panel: 10 mW nominal in  $600\Omega$ .

(b) 10 mW in  $600\Omega$  at rear terminals. An alternative version providing one watt into 15 ohms for an external loudspeaker is available to special order.

(c) 1 mW in  $600\Omega$  'line' outlet. The preset level is independent of the A.F. Gain control setting.

Overall A. F. Distortion:

Less than 5%.

Overall A. F. Response:

With a selectivity bandpass of 13 kHz the audio frequency output level from 100 Hz to 6000 Hz. will not vary more than 4dB from peak response.

Meter Indication:

(a) R. F. Levels.

(b) A. F. level to line.

**Controls:**

- (a) Meter Switch (AF level/R.F. level)
- (b) Frequency Readout - In-line Digital
- (c) 'Megahertz' Tuning
- (d) 'Kilohertz, Tuning
- (e) System Switch
- (f) DET/B.F.O. Mode
- (g) B.F.O. Tuning
- (h) R.F./I.F. Gain
- (i) A.F. Gain
- (j) A.F. Line Level
- (k) R.F. Tune
- (l) R.F. Bandswitch
- (m) Tuning Locks
- (n) Dimmer (scale illumination)
- (o) Calibrate - Fine Tune
- (p) Bandwidth Switch
- (q) R.F. Attenuator
- (r) 2nd V.F.O. INT/EXT switch

**External Connections:**

- (a) Antenna Input
- (b) I.F. Outputs
- (c) A.F. Line Output
- (d) External L.S. Output
- (e) 2nd V.F.O. Output
- (f) 2nd F.V.O. Input
- (g) 1 MHz Output
- (h) 1 MHz Input
- (i) 1.7 MHz input/output
- (j) L.F. Adaptor Input
- (k) Panoramic Adaptor Output
- (l) A.C. Supply input



**Selectivity:**

Three i. f. bandwidths fitted as standard, although positions available for up to five filters.

**Standard Filters:**

3 dB Bandwidth	6/60 dB Shape Factor
8 kHz	1 : 4
3 kHz	1 : 4
200 Hz	1 : 10

**Additional Filters Available:**

13 kHz	1 : 4
1.2 kHz	1 : 4
500 Hz	1 : 10

**Cross Modulation:**

For a wanted signal of level up to 1 mV and with appropriate use of Aerial Attenuator (AE ATT) control, an interfering signal 20 kHz removed and modulated 30% must have a level greater than 45 dB above that of the wanted signal to produce a cross modulation of 3%. The ratio of wanted to unwanted signal level is improved at the rate of 2 dB for each one percent up to 10 percent off tune.

**Intermodulation:**

Better than 80 dB on 1 microvolt for interfering signals at least 10% removed from the wanted signal.

**Blocking:**

For levels of wanted signal up to 1 mV, and with appropriate use of the Aerial Attenuator (AE ATT control) an interfering signal 20 kHz removed must have a level 56 dB greater than the wanted signal to reduce the signal by 3 dB. The ratio of wanted to unwanted signal level is improved at the rate of 2 dB per one percent up to 10% off tune.

**Spurious Response to  
External Signals (Image, etc):**

- (a) External signal less than 10% off tune shall be greater than plus 60 dB relative to 1 microvolt to produce a spurious signal equivalent to 1 microvolt.
- (b) With tuned aerial (antenna) external signals more than 10% off tune shall be greater than plus 80 dB relative to 1 microvolt to produce a spurious signal equivalent to 1 microvolt.

## CHAPTER 2

### TEST AND MAINTENANCE EQUIPMENT

1. The following items of test equipment are required for the procedures in Chapter 3 and 4.

#### R. F. Signal Generator

NOTE: A good quality signal generator, with a frequency range up to 8 MHz and a source impedance of 75 ohms is suitable for many of the tests, but to meet all requirements two signal generators of the following specification are required:

Frequency Range	10 kHz to 70 MHz
Output Impedance	75 ohms
A. M. Modulation distortion	less than 10%
Example:	Marconi TF. 144H, with 50 to 75 ohms adaptor and 20 dB pad for each instrument.

#### Multimeter AC/DC

Sensitivity	20 000 ohms/volt
Range	0 to 300 volts
Accuracy	2% of full scale
Example	AVO Model 8

#### Electronic Voltmeter (RF Voltmeter)

Input impedance	Not less than 1 megohm
Range (0 dB = 0. 775 volts)	Minus 50 dB to plus 10 dB
Frequency Range	Up to 70 MHz
Example	Airmec Type 301

#### Electronic Voltmeter (L. F.)

Input Impedance	Not less than 1 megohm
Range (0 dB = 0. 775 volts)	Minus 50 dB to plus 10 dB
Example	Advance Advac VM77

#### Digital Frequency Meter (Counter)

Frequency Range	1 Hz to 70 MHz
Accuracy	Internal reference frequency 1 part in $10^6$ plus or minus 1 count.
Example	Racal Type SA. 550 with probe for high input impedance.

### Output Power Meter

Frequency Range	100 Hz to 6000 Hz
Input Impedance	15 ohms and 600 ohms
Example	Marconi TF. 893A

### Noise Generator

Output impedance	75 ohms
Example	Marconi TF. 1106

### Oscilloscope

Frequency Range	0 to 30 MHz with dual trace.
Example	Tektronix 545A

### Waveform Analyzer

Frequency Range	100 Hz to 10 kHz; capable of measuring to 40 dB minimum.
Example	Wayne Kerr A321

### Audio Signal Generator

Frequency Range	100 Hz to 8000 Hz
Example	Advance Type J2

### Telephone Headset

600 ohm impedance

### Tools

Spanners:  $\frac{1}{4}$  inch AF (6.5 mm) and 10/32 UNF Hex.  
Screwdrivers: Various  
Hexagonal wrench (Allen keys): various sizes  
Soldering iron.

### Terminating Resistors

100 ohms	$\frac{1}{4}$ watt
75 ohms	$\frac{1}{4}$ watt
330 ohms	$\frac{1}{4}$ watt
27 ohms	$\frac{1}{4}$ watt

### Heat Shunt

Required when soldering certain coil assemblies to the printed circuit board. Refer to the next page for details.

# RA. 1217 MAINTENANCE MANUAL

## PREFACE

### Handbook Guide

This Volume contains detailed information for maintenance purposes. It is assumed that the user also has a copy of the RA.1217 Operators Manual, to which reference should be made for general information concerning installation, operation, and technical principles.

### Variants

Chapters 1 to 8 of this Volume refer to the basic RA. 1217 receiver. Details of any variant models will be given in appendices, which will be inserted immediately prior to the illustrations at the rear of the handbook.

## CHAPTER 8

### LIST OF COMPONENTS

#### CONTENTS

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MAIN I. F. MODULE	8 - 32
POWER UNITS	
TYPE PU. 1153	8 - 40

NOTE: Component values are quoted as follows:

#### Resistors

No suffix = ohms  
Suffix 'k' = kilohms  
Suffix 'M' = megohms

#### Capacitors

No suffix = microfarads  
Suffix 'p' = picofarads

## REPLACEMENT MODULES AND ASSEMBLIES

- NOTES. 1. Table 1, below, lists the "plug-in" modules which can be quickly fitted in the receiver and are therefore essential to a rapid service procedure. Table 2 on the next page lists the principal component board assemblies likely to be required in servicing the various modules.
2. When ordering a replacement module please state the module title and the part number. When ordering a circuit board or sub-assembly please state the module in which the part is fitted, as well as the name of the item and the part number, as listed in Table 2.
3. Always quote the receiver title (RA.1217A, RA.1217B etc) and the serial number.

TABLE 1

### Module Assemblies

<u>Name</u>	<u>Part Number</u>
R.F. Unit (see NOTE 2 below)	CA.38538/A or B
1st Mixer and 40 MHz Filter	BA.28211
2nd Mixer	CA.30959
3rd Mixer	CA.35970
1st VFO	CA.28120
2nd VFO	CA.28101/B
37.5 MHz Generator with 1 MHz Oscillator Amp and Calibrator	CA.28276/B
37.5 MHz Band-Pass Filter Unit	BA.28192
I.F. Module (455 kHz output)	DA.38580/A
I.F. Module (100 kHz output)	DA.38580/B
Power Unit PU.1153	CA.38640

NOTE 1: Replacement printed circuit boards are listed in Table 2 on the following page. Note that two types of i.f. converter boards are available (100 kHz and 455 kHz) and two types of audio amplifier board (10mW and 1-watt). Ensure that the correct type is ordered as fitted to the receiver being serviced.

NOTE 2: R.F. Units

R.F. Unit type CA.38538/A has soldered connections via pins on the side of the unit. R.F. Unit type CA.38538/B is fitted with a Cannon multi-way connector. Type CA.38538/A is fitted in earlier versions of the RA.1217.

TABLE 2

Sub-Circuit Assemblies

<u>R.F. Unit</u>	<u>Part No.</u>	<u>1st. Mixer</u>	<u>Part No.</u>
0-30 MHz Filter	AA.28188/A	Mixer Board	BA.28215
R.F. Range Coil & Switch Assy.	CA.38539	40 MHz Filter	BA.28197
R.F. Amp Board	BA.28155/B		
Attenuator Switch Assy.	AA.34081		
 <u>2nd. Mixer</u>		 <u>3rd. Mixer</u>	
Mixer Board	BA.28177	Mixer Board	BA.35966
 <u>1st. VFO</u>		 <u>2nd. VFO</u>	
Oscillator Board	BA.35195	Oscillator Board	BA.35808
Amplifier Board	BA.32535	Amplifier Board	BA.35807
Amplifier Board	BA.28128	Component Board	AA.39599
 <u>1 MHz Amp and Calibrator</u>		 <u>Power Unit Type PU.1153 (AC/DC)</u>	
Complete Assembly	BA.28285/B	Component Board	BA.37549
1 MHz Amplifiers	BA.32858		
OSC & Calibrator	BA.32860		
 <u>37.5 MHz Generator</u>		 <u>Audio Amp. Board</u>	
		10 mW.	BA.31462
		or	
		1 watt.	BA.39442
Complete Sub-Assembly	BA.28284/B	<u>Control Board</u>	BA.38883
Harmonic Gen. Board	BA.32854		
Harmonic Filter Assembly	BA.35836	<u>H.T. Filter Board</u>	AA28179/B
Harmonic Mixer Board	BA.37894		
37.5 MHz Amp. Board	BA.32850		
 <u>BFO (600 kHz)</u>			
Oscillator Board	BA.30540	<u>1st. I.F. Amp. Unit</u>	BA.28203
Amplifier Board	BA.30542	<u>Circuit Board</u>	BA.31474
 <u>I.F. Module</u>			
I.F. Amp. Board	BA.30533	Converter: 455 kHz	
H.T. Supply Filter	AA.30535	Osc. Board (455 kHz)	BA.38568A
Detector Board	BA.28236	Amp. Board (455 kHz)	BA.34783A
A.G.C. Board	BA.31466/B	Converter: 100 kHz	
		Osc. Board (100 kHz)	BA.38568B
		Amp. Board (100 kHz)	BA.34783B

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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# MAIN CHASSIS ITEMS

(Fig. 16)

- NOTES 1: Components prefixed '1' are located in various parts of the chassis, but are not in any module.
- 2: Components prefixed '2' are located in the Bandwidth and BFO switch assembly.
- 3: Components prefixed '3' are located on the Meter Control Board.
- 4: Components prefixed '4' are located on the H.T. Filter board.  
(chassis underside)

	ohms	Resistors				
1R1		not used				
1R2		not used				
1R3		not used				
1R4	1.2k	Metal Oxide	5		906346	Electrosil TR5
1R5	680	Metal Oxide	5		910113	Electrosil TR4
1R6	560	Metal Oxide	5		907496	Electrosil TR5
1R7	100	Metal Oxide	5		908276	Electrosil TR4
1R8	100	Metal Oxide	5		907491	Electrosil TR5
1R9	330	Metal Oxide	5		908153	Electrosil TR5
2R1	390	Composition	0.1	10	902503	Erie 15
2R2		not used				
2R3		not used				
2R4	100	Metal Oxide	5		908276	Electrosil TR4
2R5		not used				
2R6		not used				
2R7	3.3k	Metal Oxide	5		900991	Electrosil TR4
3R1	3.9k	Metal Oxide	5		906029	Electrosil TR5
3R2	22k	Metal Oxide	5		906553	Electrosil TR5
3R3	5.6k	Metal Oxide	5		906032	Electrosil TR5
		Potentiometers				
1RV1		not used				
1RV2	1k	Dimmer: preset			ASW35811	
1RV3	500	Cal-Fine Tune: variable				Reliance HEL 05-B0-5 Style 2650/138
2RV1	10k	A.F. Level: preset			900615	Plessey MP
2RV2	1k	R.F. Gain)			BSW38716	
2RV3	10k	A.F. Gain) dual control			BSW38716	
3RV4	47k	'S' Meter Setting: Linear: preset			908635	Plessey MP
4RV1	2.2k	AGC Set: Linear			909836	Plessey MP
		Capacitors				
1C1	.001	Ceramic	volts 350	20	902122	Lemco 310K



Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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MAIN CHASSIS ITEMS (continued)

(Fig. 16)

Capacitors (contd)

				volts		
1C2	20.5p	Variable B.F.O. Tune			AD38584	
1C3	0.1	Polyester	250	20	909428	Mullard C280AE/P100K
1C4	0.22	Ceramic	50	-20+50	908338	T.C.C. CML10
1C5	0.1	Polyester	250	10	909847	Mullard C280AE/A100K
1C6		not used				
1C7		not used				
1C8	0.1	Polyester	250	20	909428	Mullard C280AE/P100K
1C9	0.1	Polyester	250	20	909428	Mullard C280AE/P100K
1C10	0.1	Polyester	250	20	909428	Mullard C280AE/P100K
1C11	0.1	Polyester	250	20	909428	Mullard C280AE/P100K
1C12	500	Electrolytic	25	-20+50	900748	Hunts MEF37T
1C13	10	Electrolytic	20	20	905399	S.T.C. 472/LWA/401GA
1C14	.0022	Ceramic	350	20	902126	Lemco 310K
1C15	.033	Polyester	150	5	908114	Wima Tropyfol M.
1C16	0.1	Polyester	250	20	909428	Mullard C280AE/P100K
1C17	500	Electrolytic	25	-20+50	900748	Hunts MEF37T
2C1	0.1	Polyester	250	10	909847	Mullard C280AE/A100K
2C2	Refer to	1C2 in B.F.O. Assembly.	Page 8	- 29.		
2C3	1	Electrolytic	40	-10+100	910952	Mullard C426 AS/G1
4C1	0.1	Polyester	250	10	909847	Mullard C280AE/A100K
4C2		not used				
4C3	50	Electrolytic	25	-10+50	908798	Mullard C426AR/F50

Transformers

1T1	Audio output transformer	CT39257
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Switches

1SA	Microswitch a.g.c.	911132	} Unimax DPST Type USMF
1SB	Microswitch h.t.	911132	
1SC/1	)Power switching: part	BSW38691	
1SC/2	)of System switch 1SE		
1SD	2nd V.F.O. INT/EXT: break before make	ASW38678	
1SE	System switch	BSW38691	
1SF	Meter switch: break before make	912063	E.M.I. S5
2SA	Bandwidth switch	BSW38719	
2SB	DET-B.F.O. Mode	BSW38585	

Cat. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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## MAIN CHASSIS ITEMS (continued)

(Fig. 16)

### Connectors

#### Plugs (Free)

XLP1	Antenna plug: 75 ohms coaxial	905034	Transradio BN 1/7
LPL2	Chassis wiring to Power module:		
	15-way	908598	Cannon DAM15P
LLP3	I.F. module input: coaxial:		
	elbow	908370	Belling Lee L1403/RFP/Ag
Plug free: 12-way		906612	Plessey Mk4 2CZ83302/5
Accessory Set for 12-way plug			Plessey 508/1/03013/205

#### Sockets

LSKT1	I.F. connector: free: 37-way	908603	Cannon DCM37S
LSKT2	Double ended bulkhead adaptor	908405	Belling Lee L1403/BS/Ag
LSKT3	Double ended bulkhead adaptor	908405	Belling Lee L1403/BS/Ag
LSKT4	1st Mixer: insert	908600	Cannon DM53743-5001
LSKT5	HF to 1st Mixer	908604	Sealelectro 5BC
LSKT6	37.5 MHz Filter: insert	908600	Cannon DM53743-5001
LSKT7	2nd Mixer connector - multiway	911160	Cannon DBMF9W4S
LSKT8	3rd Mixer connector - multiway	911160	Cannon DBMF9W4S
LSKT9	37.5 MHz Gen. connector-multiway	908602	Cannon DBM9W4S
LSKT10	2nd VFO connector-multiway	908599	Cannon DBM13W3S

NOTE: The coaxial inserts in the Cannon connectors SKT7, SKT8, SKT9 and SKT10 can be renewed separately, using coaxial insert DM53743-5001: Part No. 908600.

LSKT11	12-way outlet: fixed.	906607	Plessey Mk4 CZ63979/5
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NOTE: The free coaxial plugs for connection to the rear panel sockets LSKT12 to LSKT17 are BNC 75Ω Part number 905034

LSKT12	2nd VFO IN: fixed, 75Ω Coaxial	907457	Transradio BN 12/7
LSKT13	2nd VFO OUT: fixed, 75Ω Coaxial	907457	Transradio BN 12/7
LSKT14	L.F. fixed, 75Ω Coaxial	907457	Transradio BN 12/7
LSKT15	PAN fixed, 75Ω Coaxial	907457	Transradio BN 12/7
LSKT16	1 MHz IN fixed, 75Ω Coaxial	907457	Transradio BN 12/7
LSKT17	1 MHz OUT: fixed, 75Ω Coaxial	907457	Transradio BN 12/7
LSKT18	Connector 5-way, free (not fitted to earlier receivers)	911785	Cannon DEM5W1S

Coaxial insert to SKT18		907076	Cannon 53742-5001
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JK1	Phone jack socket	901509	Igranic P71
Phones jack plug (free) to fit JK1		901557	Igranic P50

### Terminal Blocks

TB1	6-way. Refer to I.F. Module details		
TB2	1st V.F.O. h.t. connection	AD398351	(not fitted on early receivers)
TB3	(in fine tune circuit)	905221	Wingrove & Rogers TS8-04

### Meter

ML	'S' Meter	BD35519	
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### Dial Lamps

LLP1-LLP3		908605	Vitality 14v690
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Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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### MAIN CHASSIS ITEMS (continued)

#### Diodes

3D1 to 3D4:		Meter rectifiers			900071	Mullard OA91
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#### Crystal Bandpass Filters

13 kHz	BD38733/A	995467	3 kHz	BD38733/C	995049
8 kHz	BD38733/B	995028	1.2 kHz	BD38733/D	995029
6.5 kHz	BD38733/H	996029	500 Hz	BD38733/F	995503
6.0 kHz	BD38733/G	995943	200 Hz	BD38733/E	995030

### 10 mW AUDIO AMPLIFIER (BC.31462)

#### Resistors

	ohms					
R1	5.6k	Metal Oxide	5	908273	Electrosil	TR4
R2	2.2k	Metal Oxide	5	908270	Electrosil	TR4
R3	5.6k	Metal Oxide	5	908273	Electrosil	TR4
R4	330	Metal Oxide	5	908268	Electrosil	TR4
R5	2.2k	Metal Oxide	5	908270	Electrosil	TR4
R6	15k	Metal Oxide	5	908280	Electrosil	TR4
R7	5.6k	Metal Oxide	5	908273	Electrosil	TR4
R8	22k	Metal Oxide	5	908269	Electrosil	TR4
R9	150k	Metal Oxide	5	908277	Electrosil	TR4
R10	150k	Metal Oxide	5	908277	Electrosil	TR4
R11	470	Metal Oxide	5	900992	Electrosil	TR4
R12	470	Metal Oxide	5	900992	Electrosil	TR4
R13	1k	Metal Oxide	5	908267	Electrosil	TR4
R14	150k	Metal Oxide	5	908277	Electrosil	TR4
R15	10k	Metal Oxide	5	900986	Electrosil	TR4
R16	68k	Metal Oxide	5	908279	Electrosil	TR4
R17	2.2k	Metal Oxide	5	908270	Electrosil	TR4
R18	68	Metal Oxide	5	908278	Electrosil	TR4

#### Capacitors

C1	80	Electrolytic	16	-10+50	908810	Mullard C426 AR/E80
C2	.022	Polyester	250	20	900082	Mullard C280 AE/P22K
C3	2.5	Electrolytic	16	-10+50	908808	Mullard C426 AS/E2.5
C4	80	Electrolytic	16	-10+50	908810	Mullard C426 AR/E80
C5	2.2	Tantalum	20	20	908316	U.Carbide K2R2J20S
C6	80	Electrolytic	80	-10+50	908810	Mullard C426 AR/E80
C7	80	Electrolytic	80	-10+50	908810	Mullard C426 AR/E80
C8	.001	Silver Mica	500	20	908315	Erie Microcap
C9	80	Electrolytic	16	-10+50	908810	Mullard C426 AR/E80
C10	10	Electrolytic	16	-10+50	900068	Mullard C426 AR/E10
C11	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C12	50	Electrolytic	25	-10+50	908798	Mullard C426 AR/F50

#### Transformers

T1	Transformer assembly	CT 31476
T2	Transformer assembly	CT 31478
T3	Transformer assembly	CT 31477

#### Transistors

VT1	p-n-p	911929	Mullard BC107
VT2, VT3, VT4	n-p-n	909017	Texas 2N929

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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# AUDIO AMPLIFIER BOARD

(BC.39442)

		<u>Resistors</u>				
	ohms		watts			
R1	4.7k	Composition	0.1	10	902516	Erie 15
R2	1.5k	Composition	0.1	10	902510	Erie 15
R3	12k	Composition	0.1	10	902521	Erie 15
R4	1k	Composition	0.1	10	902508	Erie 15
R5	390	Composition	0.1	10	902503	Erie 15
R6	1k	Composition	0.1	10	902508	Erie 15
R7	1	Wirewound	1.5	10	911767	Welwyn W21
R8	1	Wirewound	1.5	10	911767	Welwyn W21
R9	15	Composition	0.1	10	902486	Erie 15
R10	33k	Composition	0.1	10	902526	Erie 15
R11	3.9k	Composition	0.1	10	902515	Erie 15
R12	120	Composition	0.1	10	902497	Erie 15
R13	3.3k	Composition	0.1	10	902514	Erie 15
R14	22k	Composition	0.1	10	902524	Erie 15
R15	100	Composition	0.1	10	902496	Erie 15
R16	390	Composition	0.1	10	902503	Erie 15
R17	1k	Composition	0.1	10	902508	Erie 15
R18	470	Composition	0.1	10	902504	Erie 15
R19	10	Composition	1/4	10	902411	Erie 16
		<u>Potentiometers</u>				
RV1	200k				911766	Morganite 81E
RV2	2k				911765	Morganite 81E
		<u>Capacitors</u>	volts			
C1	32	Electrolytic	10	-10+50	911764	Mullard C426AR/D32
C2	1	Electrolytic	40	-10+100	910952	Mullard C426AS/G1
C3	10p	Polystyrene	125	2	900814	Salford PF
C4	80	Electrolytic	16	-10+50	908810	Mullard C426AR/E80
C5	0.1	Polyester	250	20	909428	Mullard C280AE/P100K
C6*	1	Tantalum	25	20		S.T.C. TAG 1.0/25
C7	470p	Polystyrene	125	5	905362	Salford PF
C8	10	Tantalum	15	20	908735	S.T.C. TAG10/15
		<u>Transistors</u>				
VT1		n-p-n			911929	Mullard BC107
VT2		n-p-n			911929	Mullard BC107
VT3		p-n-p			911928	Mullard BCY71
VT4		n-p-n			908753	Mullard BFY51
VT5		n-p-n			908753	Mullard BFY51
VT6, VT7, VT8		n-p-n			909927	Texas 2N3711
		<u>Diodes</u>				
D1 and D2		Semi-conductor			906001	Texas 1S130

\*NOTE: C6 is Mullard C426 AS/G1 in early production versions

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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R. F. MODULE

Resistors

Coil Board and Capacitor Assembly

	ohms		watts	%		
2R1	1 kΩ	Metal Oxide		5	906031	Electrosil TR5
2R2	100	Metal Oxide		5	908276	Electrosil TR4
2R3	100	Metal Oxide		5	908276	Electrosil TR4

Ae. Attenuator Switch Assembly

R1	56	Carbon Hi. Stab.		5	906559	Erie N6
R2	15	Carbon Hi. Stab.		5	908300	Erie N6
R3	56	Carbon Hi. Stab.		5	906559	Erie N6
R4	33	Carbon Hi. Stab.		5	908301	Erie N6
R5	47	Carbon Hi. Stab.		5	906435	Erie N6
R6	33	Carbon Hi. Stab.		5	908301	Erie N6
R7	15	Carbon Hi. Stab.		5	908300	Erie N6
R8	56	Carbon Hi. Stab.		5	906559	Erie N6
R9	56	Carbon Hi. Stab.		5	906559	Erie N6
R10	82	Metal Oxide		5	908290	Electrosil TR4

R.F. Amplifier Board (BC.28155)

3R1	8.2k	Metal Oxide		5	908275	Electrosil TR4
3R2	820	Metal Oxide		5	908282	Electrosil TR4
3R3	560	Metal Oxide		5	909841	Electrosil TR4
3R4	1.8k	Metal Oxide		5	908283	Electrosil TR4
3R5	18k	Metal Oxide		5	908272	Electrosil TR4
3R6	18k	Metal Oxide		5	908272	Electrosil TR4
3R7	10k	Metal Oxide		5	900986	Electrosil TR4
3R8	390	Metal Oxide		5	908472	Electrosil TR4
3R9	3.3k	Metal Oxide		5	900991	Electrosil TR4
3R10	33	Metal Oxide		5	908690	Welwyn F25
3R11		not used				
3R12		not used				
3R13		not used				
3R14	18k	Metal Oxide		5	908272	Electrosil TR4
3R15	10k	Metal Oxide		5	900986	Electrosil TR4
3R16	390	Metal Oxide		5	908472	Electrosil TR4
3R17	3.3k	Metal Oxide		5	900991	Electrosil TR4
3R18	33	Metal Oxide		5	908690	Welwyn F25
3R19	22	Metal Oxide		5	911495	Electrosil TR4

Thermistor

3TH1					909839	Mullard VA1038
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Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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### R.F. MODULE (continued)

#### Potentiometer

4RV1 2.2k (On H.T. Filter below chassis) 909836 Plessey MP Linear

#### Capacitors

#### Module

volts

C1 not used  
C2 0.1 Polyester 250 20 909428 Mullard C280AE/P100K

#### 0 - 30 MHz Filter (AC.28188/A)

1C1	68p	Polystyrene	30	2 $\frac{1}{2}$	908321	Suflex HS7/A
1C2	82p	Polystyrene	30	2 $\frac{1}{2}$	908322	Suflex HS7/A
1C3	18p	Polystyrene	30	1p	908323	Suflex HS7/A
1C4	68p	Polystyrene	30	2 $\frac{1}{2}$	908321	Suflex HS7/A
1C5	68p	Polystyrene	30	2 $\frac{1}{2}$	908321	Suflex HS7/A

#### Coil and Capacitor Assembly

2C1	6p	trimmer: tubular			901987	Mullard COO4EA/6E
2C2	6p	trimmer: tubular			901987	Mullard COO4AE/6E
2C3	6p	trimmer: tubular			901987	Mullard COO4AE/6E
2C4	6p	trimmer: tubular			901987	Mullard COO4AE/6E
2C5	6p	trimmer: tubular			901987	Mullard COO4AE/6E

2C6a (Variable: R.F. TUNE. Minimum 8.5 pF)  
2C6b (range 157 pF each section)

Wingrove & Rogers C78-22/57

2C7 not used

2C8	4.7p	Ceramic	750	1 $\frac{1}{2}$ p	902007	Lemco 310P100
2C9	680p	Silver Mica	300	2	902254	J & M C12S
2C10	680p	Silver Mica	300	2	902254	J & M C12S
2C11	6.8p	Ceramic	750	1 $\frac{1}{2}$ p	902009	Lemco 310P 100

#### R.F. Amplifier Board (BC.28155)

3C1	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
3C2	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
3C3	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
3C4	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
3C5	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
3C6	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
3C7	68p	Polystyrene	30	2 $\frac{1}{2}$	908321	Suflex HS7/A
3C8	100p	Polystyrene	30	2 $\frac{1}{2}$	908241	Suflex HS7/A
3C9	27p	Polystyrene	30	1p	908325	Suflex HS7/A
3C10	220p	Polystyrene	30	2 $\frac{1}{2}$	908320	Suflex HS7/A
3C11	33p	Polystyrene	30	1p	906497	Suflex HS7/A
3C12	150p	Polystyrene	30	2.	908331	Suflex HS7/A
3C13	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
3C14	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
3C15	100p	Polystyrene	30	2 $\frac{1}{2}$	908241	Suflex HS7/A

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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# R.F. MODULE (continued)

3C16	18p	Polystyrene	30	±1p	907171	Suflex HS7/A
3C17	220p	Polystyrene	30	2½	908320	Suflex HS7/A
3C18	33p	Polystyrene	30	±1p	906497	Suflex HS7/A
3C19	82p	Polystyrene	30	2½	908322	Suflex HS7/A
3C20	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
3C21	68p	Polystyrene	30	2½	908321	Suflex HS7/A

## Inductors and Transformers

### 0 - 30 MHz Filter

1L1	Aerial Filter Coil	CT.32963
1L2	Aerial Filter Coil	CT.32964
1L3	Aerial filter Coil	CT.32963

### Coil and Switch Assembly

2L1	Coil Assembly	CT.32934/B
2L2	Coil Assembly	CT.32933/B
2L3	Coil Assembly	CT.32932/B
2L4	Coil Assembly	CT.32931/B
2L5	Coil Assembly	CT.32930/B

### R.F. Amplifier Board

3L1	Coil Assembly: L.P. Filter	CT.28154
3L2	Coil Assembly: L.P. Filter	CT.28152
3L3	Coil Assembly: L.P. Filter	CT.28154
3L4	Coil Assembly: L.P. Filter	CT.28152
3T1	Transformer Assembly	CT.28149
3T2	Transformer Assembly	CT.28149

### Switches

2SA	R.F. RANGE Switch	BSW38550
SB	AE ATT (R.F. Attenuator Switch)	BSW28141
Switch SB Assembly, complete		AA 34081

### Transistors

#### R.F. Amplifier Board

3VT1		900618	Texas 2S303
3VT2		909111	RCA 2N3478
3VT3		909111	RCA 2N3478

### Diodes

#### R.F. Amplifier Board

3D1 to 3D4	See NOTE below	911796	Hughes HPS1672/B
3D5 and 3D6	Semi-conductor diodes	908343	Texas 1S920

NOTE: In later production, diodes 3D1 to 3D4 are Hughes HS1842. When the HS1842 are fitted the diodes 3D7 to 3D10 are removed.

Cct. Ref.	Value	Description	Ret.	Tol. %	Racal Part No.	Manufacturer
<u>R.F. MODULE (continued)</u>						
		See NOTE				
3D7 to 3D10		at foot of page 8-10			911796	Hughes HPS1672/B
3D11 and 3D12		Semi-conductor diodes			909837	Hughes HS9003
<u>Plugs and Sockets</u>						
R.F. INPUT		Antenna: socket 75 $\Omega$ fixed				Transradio BN12/7
PL1		Connector fixed, 5-way				Cannon DEM5W1P
Coaxial insert to PL1						Cannon DM53740-5001
<u>Fuse</u>						
1FS1		500 mA Aerial protection			906850	Beswick TDC134
Fuseholder for 1FS1					908352	Belling Lee L1383
<u>Miscellaneous Items</u>						
X1		Ferrite Bead				Mullard FX1242
3X1		Ferrite Bead on 3VT3				Mullard FX 1242
Voltage Surge Arrester (Spark Gap)						Siemens America Inc. Type B1-A230
Relay, Muting 340 $\Omega$ 17.6V						C.P. Clare Type F F.L. 7631



Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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# FIRST MIXER AND 40 MHz FILTER

(BC.28211)

## Resistors

### 1st. Mixer Board (BC.28215)

ohms

R1	56	Metal Oxide		5	908289	Electrosil TR4
R2	15k	Metal Oxide		5	908280	Electrosil TR4
R3	12k	Metal Oxide		5	908274	Electrosil TR4
R4	2.7k	Metal Oxide		5	908294	Electrosil TR4
R5	2.7k	Metal Oxide		5	908294	Electrosil TR4

### 40 MHz Filter (AC.28197)

R1	1k	Metal Oxide		5	908267	Electrosil TR4
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## Potentiometers

### 1st. Mixer Board

RV1	2.2k				909838	Ancillary Dev. Type T.0.5.
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## Capacitors

### 1st. Mixer Board (BC.28215)

C1	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C2	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C3	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C4	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C5	39p	Polystyrene	30	1p	905374	Suflex HS7/A
C6	39p	Polystyrene	30	1p	905374	Suflex HS7/A

### 40 MHz Filter (AC.28197)

C1	47p	Polystyrene	30	$2\frac{1}{2}$	908318	Suflex HS7/A
C2	47p	Polystyrene	30	$2\frac{1}{2}$	908318	Suflex HS7/A
C3	47p	Polystyrene	30	$2\frac{1}{2}$	908318	Suflex HS7/A
C4	47p	Polystyrene	30	$2\frac{1}{2}$	908318	Suflex HS7/A
C5	47p	Polystyrene	30	$2\frac{1}{2}$	908318	Suflex HS7/A
C6	47p	Polystyrene	30	$2\frac{1}{2}$	908318	Suflex HS7/A
C7	56p	Polystyrene	30	$2\frac{1}{2}$	908319	Suflex HS7/A
C8	470p	Polystyrene	30	$2\frac{1}{2}$	908317	Suflex HS7/A

## Inductors

### 1st. Mixer Board

T1	Transformer				CT 28212	
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Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
<u>FIRST MIXER AND 40 MHz (continued)</u>						
<u>40 MHz Filter</u>						
L1		Coil Assembly			CT 31031	
L2		Coil Assembly			CT 31030	
L3		Coil Assembly			CT 31030	
L4		Coil Assembly			CT 31030	
L5		Coil Assembly			CT 31030	
L6		Coil Assembly			CT 31030	
L7		Coil Assembly			CT 31030	
L8		Coil Assembly			CT 31030	
<u>Transistors</u>						
VT1					906517	Texas 2N918
VT2					906517	Texas 2N918
<u>Plugs and Sockets</u>						
PL1		From R.F. Unit			906391	Belling Lee L1403/FP/Ag.
PL2		-16V supply			908340	Sealectro FT-M-4
PL3		Connects to bulkhead adaptor				
		SKT2			908370	Belling Lee L1403 RFP/Ag.
PL4		To 2nd. mixer			908341	Cannon insert
						DM 53740-5001

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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## SECOND MIXER

(BC.30959)

### Resistors

#### Module Chassis

	ohms					
1R1	270	Metal Oxide			908284	Electrosil TR4
1R2 + 1R3		not used				
1R4	180	Metal Oxide		5	909125	Electrosil TR4

#### Circuit Board (BC.28177)

R1	47k	Metal Oxide		5	908391	Electrosil TR4
R2	4.7k	Metal Oxide		5	900989	Electrosil TR4
R3	12k	Metal Oxide		5	908274	Electrosil TR4
R4	680	Metal Oxide		5	908390	Electrosil TR4
R5	8.2k	Metal Oxide		5	908275	Electrosil TR4
R6	2.2k	Metal Oxide		5	908270	Electrosil TR4
R7	3.3k	Metal Oxide		5	900991	Electrosil TR4
R8	10k	Metal Oxide		5	900986	Electrosil TR4
R9	3.9k	Metal Oxide		5	900990	Electrosil TR4
R10	470	Metal Oxide		5	900992	Electrosil TR4
R11		not used				
R12	56	Metal Oxide		5	908289	Electrosil TR4

### Capacitors

			volts			
C1	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C2	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C3	68p	Polystyrene	30	2 $\frac{1}{2}$	908321	Suflex HS7/A
C4	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C5	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C6	.01	Polyester	250	20	910485	Mullard C280 AE/P10K
C7	.01	Polyester	250	20	910485	Mullard C280 AE/P10K
C8	150p	Polystyrene	30	2 $\frac{1}{2}$	908331	Suflex HS7/A
C9	.01	Polyester	250	20	910485	Mullard C280 AE/P10K
C10	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C11	47p	Polystyrene	30	2 $\frac{1}{2}$	908318	Suflex HS7/A
C12	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C13	100p	Polystyrene	30	2 $\frac{1}{2}$	908241	Suflex HS7/A
C14	300p	Polystyrene	30	2 $\frac{1}{2}$	908335	Suflex HS7/A
C15	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C16	15p	Polystyrene	30	1p	908336	Suflex HS7/A
C17	56p	Polystyrene	30	2 $\frac{1}{2}$	908319	Suflex HS7/A
C18	150p	Polystyrene	30	2 $\frac{1}{2}$	908331	Suflex HS7/A
C19	15p	Ceramic	750	5	902047	Lemco 310NPO

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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## SECOND MIXER (continued)

### Transformers and Inductors

T1		37.5 MHz coupling			CT 28317	
T2		2-3 MHz output			CT 28316	
L1		Mixer load			CT 28310	
L2		Filter coil assembly			CT 28311	
L3		Filter coil assembly			CT 28312	
L4		Filter coil assembly			CT 28313	
L5		Filter coil assembly			CT 28314	
L6		Filter coil assembly			CT 28315	

### Transistors

VT1					909414	Mullard 2N3323
VT2					909414	Mullard 2N3323
VT3					910866	Texas GM290A

### Plugs and Sockets

PL1		9-way			908300	Cannon DM9W4P
		Coaxial inserts A 1 to A 4			908341	Cannon DM53740-5001

### Ferrite Bead

LX1		Ferrite Bead Assembly			AA40269	
LX2		Ferrite Bead				Mullard FX1242

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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### THIRD MDXER

(BC.35970)

#### Resistors

##### Module Chassis

	ohms	Composition	watts	%		
1R1	39			10	902491	Erie 15

##### Circuit Board (BC.35966)

R1	18k	Metal Oxide		5	908272	Electrosil TR4
R2	82k	Metal Oxide		5	908691	Electrosil TR4
R3	3.9k	Metal Oxide		5	900990	Electrosil TR4
R4	2.2k	Metal Oxide		5	908270	Electrosil TR4
R5	470	Metal Oxide		5	900992	Electrosil TR4
R6	33	Metal Oxide		5	908690	Welwyn F25
R7	82	Metal Oxide		5	908290	Electrosil TR4
R8	680	Metal Oxide		5	908390	Electrosil TR4
R9	33	Metal Oxide		5	908690	Welwyn F25
R10	5.6k	Metal Oxide		5	908273	Electrosil TR4
R11	18k	Metal Oxide		5	908272	Electrosil TR4
R12	1k	Metal Oxide		5	908267	Electrosil TR4
R13	22	Composition	0.1	10	902488	Erie 15
R14	1k	Metal Oxide		5	908267	Electrosil TR4
R15	330	Metal Oxide		5	908268	Electrosil TR4
R16	68	Metal Oxide		5	910487	Welwyn F25

#### Capacitors

##### Module Chassis

			volts			
1C1	820p	Polystyrene	30	2 $\frac{1}{2}$	908389	Suflex HS7/A
1C2	820p	Polystyrene	30	2 $\frac{1}{2}$	908389	Suflex HS7/A
1C3	.0033	Silvered Mica	200	2	902204	JMC CX22S/200
1C4	50	Electrolytic	25	-10+50	908798	Mullard C426/AR/F50
1C5	0.1	Polyester	250	20	909428	Mullard C280 AE/P100K
1C6	470p	Polystyrene	30	2 $\frac{1}{2}$	908317	Suflex HS7/A

##### Circuit Board (BC.35966)

			volts			
C1	0.1	Polyester	250	10	909428	Mullard C280 AE/P100K
C2	0.1	Polyester	250	10	909428	Mullard C280 AE/P100K
C3	680p	Silver Mica	300	2	902254	J.M.C. C12S
C4	150p	Polystyrene	30	2	908331	Suflex HS7/A
C5	.015	Silver Mica	125	1	910928	S.T.C. 454-LWA-75

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
<u>THIRD MIXER (continued)</u>						
C6	680p	Silver Mica	300	2	902254	J.M.C. C12S
C7	39p	Polystyrene	30	1p	905374	Suflex HS7/A
C8	0.1	Polyester	250	20	909428	Mullard C280 AE/P100K
C9	0.1	Polyester	250	20	909428	Mullard C280 AE/P100K
C10	68p	Polystyrene	30	2 $\frac{1}{2}$	908321	Suflex HS7/A
C11	150p	Polystyrene	30	2 $\frac{1}{2}$	908331	Suflex HS7/A
C12	0.1	Polyester	250	20	909428	Mullard C280 AE/P100K
C13	0.1	Polyester	250	20	909428	Mullard C280 AE/P100K
<u>Transformers and Inductors</u>						
<u>Module Chassis</u>						
1L1		Coil Assembly			CT 31026	
1L2		Coil Assembly			AA 38847	
<u>Circuit Board</u>						
T1		Transformer			CT 35968	
T2		Transformer			CT 35968	
T3		Transformer			CT 35968	
L1		Coil Assembly			CT 35969	
L2		Coil Assembly			CT 31023	
L3		Coil Assembly			CT 35971	
L4		Coil Assembly			CT 31022	
L5		Coil Assembly			CT 34745	
L6		Coil Assembly			CT 31021	
L7		Coil Assembly			CT 31020	
<u>Transistors</u>						
VT1		n.p.n.			900893	S.T.C. BSY27
VT2		n.p.n.			900893	S.T.C. BSY27
VT3		n.p.n.			900911	Texas 2N3478
<u>Diodes</u>						
1D1		(mounted on the module)			908349	Hughes HD1871
D1-D4		Diode Quad on circuit board			909846	Cosem A505GE
<u>Plugs and Sockets</u>						
PL1		(Plug Shell			908388	Cannon DBM9W4P
		(Plug coaxial inserts (4)			908341	Cannon DM53740-5001

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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# FIRST V.F.O.

(BC.28120)

## Resistors

### Oscillator Board (1st. V.F.O.) (AC.35195)

	ohms		watts			
R1	100	Metal Oxide		5	908276	Electrosil TR4
R2	10	Composition	0.1	10	902484	Morganite XL
R3	4.7k	Metal Oxide		5	900989	Electrosil TR4
R4	6.8k	Metal Oxide		5	900987	Electrosil TR4
R5	68	Metal Oxide		5	908278	Electrosil TR4
R6	10k	Metal Oxide		5	900986	Electrosil TR4

### Amplifier Board (1st V.F.O.) (AC.32535)

R1	68	Metal Oxide		5	908278	Electrosil TR4
R2	1.5k	Metal Oxide		5	908296	Electrosil TR4
R3	8.2k	Metal Oxide		5	908275	Electrosil TR4
R4	5.6k	Metal Oxide		5	908273	Electrosil TR4
R5	10k	Metal Oxide		5	900986	Electrosil TR4
R6	4.7k	Metal Oxide		5	900989	Electrosil TR4
R7	56	Metal Oxide		5	908289	Electrosil TR4
R8	330	Metal Oxide		5	908268	Electrosil TR4
R9	220	Metal Oxide		5	900988	Electrosil TR4
R10	680	Metal Oxide		5	908390	Electrosil TR4
R11	100	Composition	0.1	10	902496	Erie 15

### Amplifier Board (1st V.F.O.) (AC.28128)

R1	68	Metal Oxide		5	908278	Electrosil TR4
R2	1.5k	Metal Oxide		5	908296	Electrosil TR4
R3	8.2k	Metal Oxide		5	908275	Electrosil TR4
R4	5.6k	Metal Oxide		5	908273	Electrosil TR4
R5	10k	Metal Oxide		5	900986	Electrosil TR4
R6	4.7k	Metal Oxide		5	900989	Electrosil TR4
R7	56	Metal Oxide		5	908289	Electrosil TR4
R8	330	Metal Oxide		5	908268	Electrosil TR4
R9	68	Metal Oxide		5	908278	Electrosil TR4
R10	680	Metal Oxide		5	908390	Electrosil TR4

## Capacitors

### Module Assembly

		volts	%		
1C1				CA.27752	
1C2	.047		200	908722	Erie Filtercon 1201-051

Cct. Ref.	Value	Description	Rat.	Tol %	Racal Part No.	Manufacturer
<u>FIRST V.F.O. (continued)</u>						
<u>Oscillator Board (AC.35195)</u>						
C1	6.8p	Ceramic	750	$\frac{1}{2}p$	902075	Erie N750A
C2	8.5p	Trimmer			908732	Erie 562-013
C3	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C4	.047	Polystyrene	30	5	906710	Suflex HS7/A
C5	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C6	.0015	Ceramic	350	20	902124	Lemco 310K

Amplifier Board (AC.32535)

C1	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C2	.470p	Polystyrene	30	5	908396	Suflex HS7/A
C3	.0033	Ceramic Hi k	350	20	902128	Lemco 310K
C4	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C5	6.8p	Ceramic	750	$\frac{1}{2}p$	902075	Lemco 310N750
C6	.47p	Polystyrene	30	$2\frac{1}{2}$	908318	Suflex HS7/A
C7	.001	Disc Ceramicon	500	-20+80	908832	Erie K7004/861
C8	.002	Disc Ceramicon	500	-20+80		Erie K800011/861
C9	.82p	Polystyrene	30	$2\frac{1}{2}$	908322	Suflex HS7/A

Amplifier Board (AC.28128)

NOTE: Capacitors C1-C9 are identical to the Amplifier board AC.32535 above.  
 C10 .001 Disc Ceramicon 500 -20+80 908832 Erie K7004/861

Transformers and Inductors

L1 Oscillator coil assembly CT 28200

Transistors

Oscillator Board

VT1 p.n.p. 910866 Texas GM 290A

Amplifier Board BA 32535

VT1 p.n.p.  
 VT2 p.n.p. 910866 Texas GM 290A-R2044  
 Texas GM 290A

Amplifier Board BA 28128

VT1 p.n.p. 910866 Texas GM290A  
 VT2 p.n.p. Texas GM290A-R2044

Plugs and Sockets

PL1 Cable and connector assembly AA 33091/9  
 PL2 Cable and connector assembly AA 33091/6



Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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# SECOND V.F.O.

(CC.28101/B)

## Resistors

### Fine Tune Board

	ohms		watts	%		
2R1	47k	Metal Oxide		5	908391	Electrosil TR4

### Oscillator Board (BA.35808)

R1	100	Metal Oxide		5	908276	Electrosil TR4
R2	390	Metal Oxide		5	908472	Electrosil TR4
R3	2.2k	Metal Oxide		5	908270	Electrosil TR4
R4	27k	Metal Oxide		5	908295	Electrosil TR4
R5	390	Metal Oxide		5	908472	Electrosil TR4
R6	270	Metal Oxide		5	908284	Electrosil TR4
R7	390	Metal Oxide		5	908472	Electrosil TR4
R8	150	Metal Oxide		5	909121	Electrosil TR4

### Amplifier Board (BA.35807)

R1	150k	Metal Oxide		5	908277	Electrosil TR4
R2	1.8k	Metal Oxide		5	908283	Electrosil TR4
R3		not used				
R4	1.8k	Metal Oxide		5	908283	Electrosil TR4
R5	150k	Metal Oxide		5	908277	Electrosil TR4
R6	75	Metal Oxide		5	908288	Electrosil TR4
R7	6.8k	Metal Oxide		5	900987	Electrosil TR4
R8	1k	Metal Oxide		5	908267	Electrosil TR4
R9	1k	Metal Oxide		5	908267	Electrosil TR4
R10	470	Metal Oxide		5	900992	Electrosil TR4
R11	82	Metal Oxide		5	908290	Electrosil TR4
R12	18	Composition	0.1	10	902487	Erie 15
R13	68	Metal Oxide		5	908278	Electrosil TR4
R14	10k	Metal Oxide			900986	Electrosil TR4
R15	27k	Metal Oxide			908295	Electrosil TR4
R16	220	Metal Oxide			900988	Electrosil TR4
R17	22	Composition	0.1	10	902488	Erie 15
R18	1k	Metal Oxide		5	908267	Electrosil TR4
R19	4.7k	Metal Oxide		5	900989	Electrosil TR4
R20	27k	Metal Oxide		5	908295	Electrosil TR4
R21	100	Metal Oxide		5	908276	Electrosil TR4
R22	75	Metal Oxide		5	908288	Electrosil TR4

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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## SECOND V.F.O. (continued)

### Capacitors

#### Module Assembly

volts

C1		KHz tuning				Racal CA 30948
C2	8.5p	KHz tuning trimmer			908732	Erie 562-013

#### Fine Tune Board

2C1	0.1	Polyester	250	20	909428	Mullard C280AE/P100K
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#### Oscillator Board (BA.35808)

C1	.01	Ceramicon	100	-20+80	900067	Erie K800011/CD801
C2	.01	Ceramicon	100	-20+80	900067	Erie K800011/CD801
C3	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C4	47p	Ceramicon	750	2 $\frac{1}{2}$		Erie N150 Style B
C5	22p	Ceramicon	750	2 $\frac{1}{2}$	See Note	Erie NPO

NOTE: C5 is selected by test for suitable temperature coefficient. The standard component (NPO) has zero coefficient. The type actually fitted may be in the Erie range P100 (+ve t.c.) or N080 to N750 (-ve t.c.)

#### Amplifier Board

C1	1	Tantalum	35	20	909123	U. Carbide KIJ35S
C2	.01	Polyester	250	20	910485	Mullard C280 AE/P10K
C3	1	Tantalum	35	20	909123	U. Carbide KIJ35S
C4	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C5	.01	Polyester	250	20	910485	Mullard C280 AE/P47K
C6	.01	Polyester	250	20	910485	Mullard C280 AE/P10K
C7	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C8	.01	Polyester	250	20	910485	Mullard C280 AE/P10K
C9	.01	Polyester	250	20	910485	Mullard C280 AE/P10K
C10	.047	Polyester	250	20	909227	Mullard C280 AE/P10K

### Inductors

NOTE: L2 is not mounted on a board.

L1	not fitted		
L2	Oscillator coil		Racal CT 35809

### Transistors

#### Oscillator

VT1	n.p.n.	or	909113 or 906517	Semi-conductor ST70 Texas 2N918
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#### Amplifier Board

VT1	n.p.n.	(	ST70 - 909113	Semi-conductors ST70
VT2	n.p.n.	(	or	
VT3	n.p.n.	(	2N918 - 906517	Texas 2N918

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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SECOND V.F.O. (continued)

Diodes

Fine Tune Board

2D1 and 2D2	Variable capacitance diodes (15pF)			Motorola MV830
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Oscillator Board

D1	Zener 7.5V $\pm 5\%$	900897	Mullard OAZ245
D2	Zener 7.5V $\pm 5\%$	900897	Mullard OAZ245
D3	Zener 6.2V $\pm 5\%$	905395	Mullard OAZ243
D4	Zener 6.2V $\pm 5\%$	905395	Mullard OAZ243

Amplifier Board

D1	not used		
D2 and D3		908343	Texas 1S920

Plugs and Sockets

PL1	Multi-way connector	908716	Cannon DBM13W3P
	Coaxial inserts for PL1(3 off)	908341	Cannon DM53740-5001

Fine Tune Component Board Assembly containing 2R1, 2C1, 2D1 and 2D2	AC39599
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Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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### 37.5 MHz GENERATOR

(BC.28284)

#### Resistors

#### Harmonic Generator (AC.32854)

	ohms					
R1	1.8k	Metal Oxide	5	908283	Electrosil TR4	
R2	1.2k	Metal Oxide	5	908285	Electrosil TR4	
R3	820	Metal Oxide	5	908282	Electrosil TR4	
R4	390	Metal Oxide	5	908472	Electrosil TR4	
R5	390	Metal Oxide	5	908472	Electrosil TR4	

#### Harmonic Mixer (AC.37894)

R1	270	Metal Oxide	5	908284	Electrosil TR4	
R2	56	Metal Oxide	5	908289	Electrosil TR4	
R3	15k	Metal Oxide	5	908280	Electrosil TR4	
R4	5.6k	Metal Oxide	5	908273	Electrosil TR4	
R5	120	Metal Oxide	5	908286	Electrosil TR4	
R6	6.8k	Metal Oxide	5	900987	Electrosil TR4	
R7	5.6k	Metal Oxide	5	908273	Electrosil TR4	
R8	15k	Metal Oxide	5	908280	Electrosil TR4	
R9	120	Metal Oxide	5	908286	Electrosil TR4	
R10	820	Metal Oxide	5	908282	Electrosil TR4	

#### 37.5 MHz Amplifier (AC.32850)

R1	4.7k	Metal Oxide	5	900989	Electrosil TR4	
R2	4.7k	Metal Oxide	5	900989	Electrosil TR4	
R3	47k	Metal Oxide	5	908391	Electrosil TR4	
R4	680	Metal Oxide	5	908390	Electrosil TR4	
R5	12k	Metal Oxide	5	908274	Electrosil TR4	
R6	8.2k	Metal Oxide	5	908275	Electrosil TR4	

#### Potentiometer

RV1	2.2k	Mixer Balance adjustment		909838	Ancillary Developments Type T05	
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#### Capacitors

1C1	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
1C2	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
1C3	150p	Polystyrene	30	2 $\frac{1}{2}$	908331	Suflek HS7/A

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
<u>37.5 MHz GENERATOR (continued)</u>						
<u>Harmonic Generator (AC.32854)</u>						
C1		Trimmer 4.5/15p		volts	908796	Steatite N750 Type 7S Triko 02
C2	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C3	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C4	.01	Polyester	250	20	910485	Mullard C280 AE/P10K
C5	100p	Polystyrene	30	2½	908797	Suflex HS7/A
<u>Harmonic Filter (AC.32862 and AC.32548)</u>						
C1	22p	Polystyrene		±lp	906703	Suflex HS7/A
C2	2.5-6p	Pre-set Ceramic sub-micro			907886	Steatite Triko 7SON033
C3	27p	Polystyrene		±lp	908325	Suflex HS7/A
C4	7-35p	Pre-set Ceramic sub-micro			908806	Steatite Triko 7SO2N1500
C5	27p	Polystyrene		±lp	908325	Suflex HS7/A
C6	2.5-6p	Pre-set Ceramic sub-micro			907886	Steatite Triko 7SO2N033
C7	27p	Polystyrene		±lp	908325	Suflex HS7/A
C8	7-35p	Pre-set Ceramic sub-micro			908806	Steatite Triko 7SO2N1500
C9	18p	Polystyrene		±lp	907171	Suflex HS7/A
<u>Harmonic Mixer (AC.37894)</u>						
C1	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C2	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C3	.01	Ceramic	100	-20+80	909102	Erie K800011 CD801
C4	.01	Ceramic	100	-20+80	909102	Erie K800011 CD801
C5	.01	Ceramic	100	-20+80	909102	Erie K800011 CD801
C6	.01	Ceramic	100	-20+80	909102	Erie K800011 CD801
<u>37.5 MHz Amplifier (AC.32850)</u>						
C1	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C2	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C3	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C4	68p	Polystyrene	30	2½	908321	Suflex HS7/A
C5	0.1	Polyester	250	10	909847	Mullard C280 AE/P100K
C6	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C7	15p	Ceramic	750	5	902047	Lemco 310NP0
<u>Transformers and Inductors</u>						
<u>Harmonic Filter (AC.32862 and AC.32548)</u>						
L1		Coil Assembly			CT 32956	
L2		Coil Assembly			CT 32954	
L3		Coil Assembly			CT 32956	
L4		Coil Assembly			CT 32954	

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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### 37.5 MHz GENERATOR (continued)

#### Harmonic Mixer (AC.37894)

L1		Coil Assembly			CT 32957	
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#### 37.5 MHz Amplifier (AC.32850)

T1		Coil assembly inc. capacitor C4			Racal CT 28317	
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#### Transistors

##### Harmonic Generator

VT1		p.n.p.		910866	Texas GM290A	
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##### Harmonic Mixer

VT1 and VT2		p.n.p.		910866	Texas GM290A	
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##### 37.5 MHz Amplifier

VT1		p.n.p.		910866	Texas GM290A	
VT2		p.n.p.		910866	Texas GM290A	

#### Diodes

##### Harmonic Generator

D1				908347	Hughes HG 5085	
D2				908347	Hughes HG 5085	

##### 37.5 MHz Amplifier

D1 and D2				908347	Hughes HG 5085	
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#### Plugs and Sockets

PL1		Connects to bulkhead adaptor		908370	Belling Lee L1403/RFP/Ag	
SKT1		Connects to PL1 on 37.5 MHz Filter Unit		907076	Cannon insert DM53742-5001	

#### Ferrite Beads

FB1		On H.T. Filter		900461	Mullard FX 1115	
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#### 37.5 MHz Filter

NOTE: If this unit is faulty a replacement should be obtained from the Racal Service Department quoting Part number BA.28192.

#### Plugs (fixed)

PL1		Coaxial insert		908341	Cannon DM 53740-5001	
PL2		Coaxial insert		908341	Cannon DM 53740-5001	

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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# 1 Mhz AMP. OSC. & CALIBRATOR

(CC 28285)

Note: This assembly is contained in the  
37.5 MHz Generator Module.

## Resistors

	ohms		watts			
1R1	56	Metal Oxide		5	910545	Welwyn F25
1R2	22k	Composition	0.1	10	902524	Erie 15
<u>1 Mhz Amplifier Board (BC.32858)</u>						
R1	22k	Metal Oxide		5	908269	Electrosil TR4
R2	6.8k	Metal Oxide		5	900987	Electrosil TR4
R3	1k	Metal Oxide		5	908267	Electrosil TR4
R4	820	Metal Oxide		5	908282	Electrosil TR4
R5	10	Composition	0.1	10	902484	Erie 15
R6	1k	Metal Oxide		5	908267	Electrosil TR4
R7	8.2k	Metal Oxide		5	908275	Electrosil TR4
R8	6.8k	Metal Oxide		5	900987	Electrosil TR4
R9	33	Composition	0.1	10	902490	Erie 15
R10	560	Metal Oxide		5	909841	Electrosil TR4
R11	33	Metal Oxide		5	908690	Welwyn F25
R12	1k	Metal Oxide		5	908267	Electrosil TR4
R13	18k	Metal Oxide		5	900994	Electrosil TR4
R14	5.6k	Metal Oxide		5	908273	Electrosil TR4
R15	1.5k	Metal Oxide		5	908296	Electrosil TR4
R16	1.2k	Metal Oxide		5	908285	Electrosil TR4
R17	39k	Metal Oxide		5	908292	Electrosil TR4
R18	82	Metal Oxide		5	908290	Electrosil TR4
R19	68	Metal Oxide		5	908278	Electrosil TR4

## 1 Mhz Oscillator and Calibrator Board (BC.32860)

R1	39k	Metal Oxide		5	908292	Electrosil TR4
R2	10k	Metal Oxide		5	900986	Electrosil TR4
R3	4.7k	Metal Oxide		5	900989	Electrosil TR4
R4	100	Metal Oxide		5	908276	Electrosil TR4
R5	6.8k	Metal Oxide		5	900987	Electrosil TR4
R6	2.2k	Metal Oxide		5	908270	Electrosil TR4
R7	68	Metal Oxide		5	908278	Electrosil TR4
R8	4.7k	Metal Oxide		5	900989	Electrosil TR4
R9	2.2k	Metal Oxide		5	906020	Electrosil TR4
R10	10k	Metal Oxide		5	906023	Electrosil TR4

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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1 MHz AMP. OSC. & CAL. (continued)

	ohms					
		watts				
R11	4.7k	Metal Oxide		5	900989	Electrosil TR4
R12	47	Composition	0.1	10	902492	Morganite XL
R13	4.7k	Metal Oxide		5	900989	Electrosil TR4
R14	39k	Metal Oxide		5	910107	Electrosil TR4
R15	150k	Metal Oxide		5	908470	Electrosil TR4
R16	4.7k	Metal Oxide		5	900989	Electrosil TR4

Capacitors

1C1	0.22				908338	TCC CML10
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1MHz Amplifier Board (BC.32858)

				volts		
C1	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C2	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C3	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C4	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C5	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C6	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C7	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C8	.001	Ceramic Hi-K	350	20	902122	Lemco 310K
C9	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C10 *	680p	Polystyrene	30	2½	908455	Suflex HS7/A (See NOTE)
C10 *	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K

\* NOTE:- In later production if VT3 is type 2N1596 then C10 becomes 0.1 µF

C11	150p	Polystyrene	30	2½	908331	Suflex HS7/A
C12	.0015	Ceramic Hi-K	350	20	902124	Lemco 310K
C13	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C14	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K

1 MHz Oscillator and Calibrator Board (BC.32860)

C1	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C2	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C3	270p	Polystyrene	30	2½		Suflex HS7/A
C4	470p	Polystyrene	30	2½	908317	Suflex HS7/A
C5	.001	Polystyrene	30	2½	908583	Suflex HS7/A
C6	22p	Polystyrene	30	1p	906703	Suflex HS7/A
C7	7-35p	Pre-set: Steatite Ceramic				
		Sub-Micro 75			908806	Triko 02 N1500
C8	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C9	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C10	560	Polystyrene	30	2½		Suflex HS7/B
C11	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C12	.0015	Polystyrene	30	2½	910932	Suflex HS7/B
C13	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C14	560	Polystyrene	30	20	908452	Suflex HS7/A
C15	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C16	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K



Cct Ref.	Value	Description	Rat. %	Tol	Racal Part No.	Manufacturer
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1 MHz AMP. OSC. & CAL. (continued)

Transformers and Inductors

1MHz Amplifier Board

L1	Coil Assembly	CT 32955
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1MHz Osc. and Calibrator Board

L1	Coil Assembly	CT 31443
L2	Coil Assembly	CT 31442
L3	Coil Assembly	CT 31444

Transistors

1 MHz Amplifier Board

VT1	p.n.p.	909414	Motorola 2N3323
VT2	p.n.p.	909414	Motorola 2N3323
VT3	p.n.p. (earlier versions only)	909414	Motorola 2N3323
VT3	p.n.p. (fitted in later versions)		Amperex 2N1396

1 MHz Osc. and Calibrator Board

VT1	p.n.p.	909414	Motorola 2N3323
VT2	p.n.p.	909414	Motorola 2N3323
VT3	p.n.p.	909414	Motorola 2N3323

Diodes

1 MHz Amplifier Board

D1	Semi-conductor	900620	Mullard OA200
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1 MHz Osc. and Calibrator Board

D1 to D4	Semi-conductor	900620	Mullard OA200
D5	See NOTE below	900620	Mullard OA200
D6	Semi-conductor	900652	Mullard AA213

NOTE:- In later production diode D5 is replaced by resistor R16

Plugs and Sockets

PL1	(Plug shell	908388	Cannon DBM9W4P
	(Plug inserts (4)	907080	Cannon DM53741-5001

Crystals

XL1	1 MHz crystal Style D	CD 38871/A	
	Crystal Holder	900397	X2/UG

NOTE: Crystal XL1 is not required in the RA.1218 except for emergency use.

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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### B.F.O.

#### Resistors

#### 600 kHz Oscillator Board (BC.30540)

	ohms					
R1	220	Metal Oxide		5	900988	Electrosil TR4
R2	5.6k	Metal Oxide		5	908273	Electrosil TR4
R3	5.6k	Metal Oxide		5	908273	Electrosil TR4
R4	5.6k	Metal Oxide		5	908273	Electrosil TR4
R5	10k	Metal Oxide		5	900986	Electrosil TR4

#### Amplifier Board (BC.30542)

R1	5.6k	Metal Oxide		5	908273	Electrosil TR4
R2	15k	Metal Oxide		5	908280	Electrosil TR4
R3	1k	Metal Oxide		5	908267	Electrosil TR4
R4	180	Metal Oxide		5	909125	Electrosil TR4
R5	4.7k	(part of CT 35217)		10	908246	Nutec RKL10

#### Capacitors

#### B.F.O. Assembly

			volts			
2C1	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
1C2	4-20p	B.F.O. Variable tuning			AD 38584	

#### 600 kHz Oscillator Board (BC 30540)

C1	0.1	Polyester	250	10	909428	Mullard C280 AE/P100K
C2	7-35p	pre-set			908806	Steatite 7S Triko 02/N1500
C3	7-35p	pre-set			908806	Steatite 7S Triko 02/N1500
C4		not used				
C5	7-35p	pre-set			908806	Steatite 7S Triko 02/N1500
C6	7-35p	pre-set			908806	Steatite 7S Triko 02/N1500
C7	390p	Polystyrene	30	2 $\frac{1}{2}$	908243	Suflex HS7/A
C8	82p	Ceramic	750	2	902099	Erie N750B
C9	0.1	Polyester	250	20	909428	Mullard C280 AE/P100K
C10	.01	Polyester	250	20	910485	Mullard C280 AE/P10K
C11	.047	Polyester	250	20	909227	Mullard C280 AE/P47K

#### Amplifier Board (BC.30542)

			volts			
C1	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C2*	180p	Polystyrene	30	2 $\frac{1}{2}$	907884	Suflex HS7/A
C3	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K

\* C2 is part of transformer assembly CT 35216

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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B.F.O. (continued)

Transformers and Inductors

600 kHz Oscillator Board

L1		Oscillator coil			CT 35217	
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Amplifier Board

T1		600 kHz output transformer			CT 35216	
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Switches

SB		DET-B.F.O. Mode switch			BSW 38585	
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Transistors

600 kHz Oscillator Board

VT1		n.p.n.			906433	S.T.C. BSY95A
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Amplifier Board

VT1		n.p.n.			906433	S.T.C. BSY95A
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Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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# 1st I.F. AMPLIFIER UNIT

(BC 31474)

NOTE: This unit is a small module located adjacent to the crystal bandwidth filters (Fig. 18)  
The circuit is shown in Fig. 11.

## Resistors

	ohms			%		
R1	18k	Metal Oxide		5	908272	Electrosil TR4
R2	100	Metal Oxide		5	908276	Electrosil TR4
R3	4.7k	Metal Oxide		5	900989	Electrosil TR4
R4	3.9k	Metal Oxide		5	900990	Electrosil TR4
R5	1k	Metal Oxide		5	908267	Electrosil TR4
R6	470	Metal Oxide		5	900992	Electrosil TR4
R7	10	Composition	0.1	10	902484	Erie 15

## Capacitors

			volts			
C1	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C2	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C3*	180p	Polystyrene	30	2½	907884	Suflex HS7/A
C4	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C5*	.01	Silver Mica	500	20	908245	Erie Microcap
C6*	.01	Silver Mica	500	20	908245	Erie Microcap

\* Contained in L1 assembly

## Inductors

L1	Coil Assembly	CT 31472
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## Transistor

VT1	p.n.p.	909414 Motorola 2N3323
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Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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### MAIN I.F. MODULE

#### Resistors

2R1	ohms 1k	Metal Oxide		5	908267	Electrosil TR4
2R2		not used				
2R3	120	Metal Oxide		5	908286	Electrosil TR4

NOTE: 2R1 and 2R3 are not mounted on a board.

#### H.T. Supply Filter (AC 30535)

R1	100	Metal Oxide		5	908276	Electrosil TR4
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#### I.F. Amplifier Board (BC.30533)

R1	18k	Metal Oxide		5	908272	Electrosil TR4
R2	3.9k	Metal Oxide		5	900990	Electrosil TR4
R3	330	Metal Oxide		5	908268	Electrosil TR4
R4	4.7k	Carbon Film		10	908246	Nutec RKL10
R5	33	Metal Oxide		5	908690	Welwyn F25
R6	1k	Metal Oxide		5	908267	Electrosil TR4
R7	22k	Metal Oxide		5	908269	Electrosil TR4
R8	4.7k	Metal Oxide		5	900989	Electrosil TR4
R9	2.2k	Metal Oxide		5	908270	Electrosil TR4
R10	5.6k	Metal Oxide		5	908273	Electrosil TR4
R11	4.7k	Metal Oxide		5	900989	Electrosil TR4
R12	3.9k	Metal Oxide		5	900990	Electrosil TR4
R13	10k	Metal Oxide		5	900986	Electrosil TR4
R14	220	Metal Oxide		5	900988	Electrosil TR4
R15	8.2k	Metal Oxide		5	908275	Electrosil TR4
R16	4.7k	Carbon film		10	908246	Nutec RKL10
R17	3.9k	Metal Oxide		5	900990	Electrosil TR4
R18	12k	Metal Oxide		5	908274	Electrosil TR4
R19	330	Metal Oxide		5	908268	Electrosil TR4
R20	4.7k	Carbon Film		5	908246	Nutec RKL10
R21	47	Metal Oxide		5	908298	Welwyn F25
R22	1k	Metal Oxide		5	908267	Electrosil TR4

#### Detector Board (CC.28236)

R1	3.9k	Metal Oxide		5	900990	Electrosil TR4
R2	33k	Metal Oxide		5	908291	Electrosil TR4
R3	39k	Metal Oxide		5	908292	Electrosil TR4
R4	5.6k	Metal Oxide		5	908273	Electrosil TR4
R5	56	Metal Oxide		5	908289	Electrosil TR4

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
<u>I.F. MODULE (continued)</u>						
<u>Detector Board</u>						
R6	100	Metal Oxide		5	908276	Electrosil TR4
R7	2.2k	Metal Oxide		5	908270	Electrosil TR4
R8	330	Metal Oxide		5	908268	Electrosil TR4
R9	10k	Metal Oxide		5	900986	Electrosil TR4
R10		Not used				
R11	4.7k	Metal Oxide		5	900989	Electrosil TR4
R12	820	Metal Oxide		5	908282	Electrosil TR4
R13	100k	Metal Oxide		5	908293	Electrosil TR4
R14	4.7k	Metal Oxide		5	900989	Electrosil TR4
R15	1k	Metal Oxide		5	908267	Electrosil TR4
R16	33	Composition	0.1	10	902490	Erie 15
R17	6.8k	Carbon Film		10	908247	Nutec RKL10
R18	2.7k	Metal Oxide		5	908294	Electrosil TR4
R19	15k	Metal Oxide		5	908280	Electrosil TR4
R20	100	Metal Oxide		5	908276	Electrosil TR4
R21	2.2k	Metal Oxide		5	908270	Electrosil TR4
R22	5.6k	Metal Oxide		5	908273	Electrosil TR4
R23	33k	Metal Oxide		5	908291	Electrosil TR4
R24	3.9k	Metal Oxide		5	900990	Electrosil TR4
R25	56k	Metal Oxide		5	908287	Electrosil TR4
R26	1.2k	Metal Oxide		5	908285	Electrosil TR4
R27	6.8k	Metal Oxide		5	900987	Electrosil TR4
R28	22k	Metal Oxide		5	908269	Electrosil TR4
R29		Not used				
R30		Not used				
R31	82	Metal Oxide		5	908290	Electrosil TR4
R32	5.6k	Metal Oxide		5	908273	Electrosil TR4
R33	5.6k	Metal Oxide		5	908273	Electrosil TR4
<u>AGC Board (BC.31466/B)</u>						
R1	15k	Metal Oxide		5	908280	Electrosil TR4
R2	3.9k	Metal Oxide		5	900990	Electrosil TR4
R3	330	Metal Oxide		5	908268	Electrosil TR4
R4	5.6k	Carbon Film		10		Nutec RKL10
R5	22	Composition	0.1	10	902488	Erie 15
R6	1k	Metal Oxide		5	908267	Electrosil TR4
R7	18k	Metal Oxide		5	908272	Electrosil TR4
R8	12k	Metal Oxide		5	908274	Electrosil TR4
R9	1k	Metal Oxide		5	908267	Electrosil TR4
R10	18	Composition	0.1	10	902487	Erie 15

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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I.F. MODULE (continued)

A.G.C. Board

R11	10k	Carbon Film		10	908249	Nutec RKL10
R12	150k	Metal Oxide		5	908277	Electrosil TR4
R13	120k	Metal Oxide		5	908281	Electrosil TR4
R14	10k	Metal Oxide		5	900986	Electrosil TR4
R15	10k	Metal Oxide		5	900986	Electrosil TR4
R16	120k	Metal Oxide		5	908281	Electrosil TR4
R17	68k	Metal Oxide		5	908279	Electrosil TR4
R18	820k	Composition	0.1	10	902543	Erie 15
R19	1k	Metal Oxide		5	908267	Electrosil TR4
R20	2.2k	Metal Oxide		5	908270	Electrosil TR4
R21	6.8k	Metal Oxide		5	900987	Electrosil TR4
R22	15k	Metal Oxide		5	908280	Electrosil TR4
R23	820	Metal Oxide		5	908282	Electrosil TR4
R24	3.3k	Metal Oxide		5	900991	Electrosil TR4
R25	470	Metal Oxide		5	900992	Electrosil TR4

Converter Amplifier Board (BC 34783/VAR) (Top Board)

R1	6.8k	Metal Oxide		5	900987	Electrosil TR4
R2	1.8k	Metal Oxide		5	908283	Electrosil TR4
R3	100	Metal Oxide		5	908276	Electrosil TR4
R4	270	Metal Oxide		5	908284	Electrosil TR4
R5	1k	Metal Oxide		5	908267	Electrosil TR4
R6	100	Metal Oxide		5	908276	Electrosil TR4
R7	15k	Metal Oxide		5	908280	Electrosil TR4
R8	100	Metal Oxide		5	908276	Electrosil TR4
R9	1.2k	Metal Oxide		5	908285	Electrosil TR4
R10*	56k	Metal Oxide		5	908287	Electrosil TR4
R11	120	Metal Oxide		5	908286	Electrosil TR4

\* R10 is fitted only to the 100 kHz board 34783/B

Converter Oscillator Board (BC 38568/VAR) (Bottom Board)

NOTE: Except for R12, resistor details are identical in the 100 kHz (B) and 455 kHz (A) versions.

	ohms					
R1	100	Metal Oxide		5	908276	Electrosil TR4
R2	68k	Metal Oxide		5	908279	Electrosil TR4
R3	390	Metal Oxide		5	908472	Electrosil TR4
R4	4.7k	Metal Oxide		8	900989	Electrosil TR4
R5	22k	Metal Oxide		5	908269	Electrosil TR4

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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# I.F. MODULE (continued)

R6	1k	Metal Oxide		5	908267	Electrosil TR4
R7	3.3k	Metal Oxide		5	900991	Electrosil TR4
R8	18k	Metal Oxide		5	908272	Electrosil TR4
R9	100	Metal Oxide		5	908276	Electrosil TR4
R10	1k	Metal Oxide		5	908267	Electrosil TR4
R11	33	Metal Oxide		5	908690	Welwyn F25
R12	39k	(100 kHz only)		5	908292	Electrosil TR4
R13	82k	(455 kHz only)		5	908691	Electrosil TR4

## Potentiometer

### AGC Board

RV1	2.2M				908365	Plessey Type MP
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### Module Capacitors volts

C1	0.22	Ceramic	50	-20+50	908338	T.C.C. CML10
C2	0.22	Ceramic	50	-20+50	908338	T.C.C. CML10

### H.T. Supply Filter (AC.30535)

C1	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C2	.047	Polyester	250	20	909227	Mullard C280 AE/P47K

### I.F. Amplifier Board (BC.30533)

C1	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C2	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C3	10	Electrolytic	16	-10+50	900068	Mullard C426 AR/E10
C4	180p	Polystyrene	30	2½	907884	Suflex HS7/A
C5	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C6	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C7	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C8	180p	Polystyrene	30	2½	907884	Suflex HS7/A
C9	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C10	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C11	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C12	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C13	180p	Polystyrene	30	2½	909884	Suflex HS7/A
C14	50	Electrolytic	16	-10+50	908798	Mullard C426 ARF50
C15	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C16	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C17	100p	Polystyrene	30	2½	908241	Suflex HS7/A

### Detector Board

C1	180p	Polystyrene	30	2½	907884	Suflex HS7/A
C2	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C3	10	Electrolytic	16	-10+50	900068	Mullard C426 AR/E10
C4	120p	Polystyrene	30	2½	908332	Suflex HS7/A
C5	10	Electrolytic	16	-10+50	900068	Mullard C426 AR/E10



Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
<u>Detector Board</u>		<u>I.F. MODULE (continued)</u>				
C6	120p	Polystyrene	30	2½	908332	Suflex HS7/A
C7	10	Electrolytic	16	-10+50	900068	Mullard C426 AR/E10
C8	120p	Polystyrene	30	2½	908332	Suflex HS7/A
C9	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C10	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C11	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C12	100p	Polystyrene	30	2½	908241	Suflex HS7/A
C13	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C14	180p	Polystyrene	30	2½	907884	Suflex HS7/A
C15	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C16	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C17	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C18	330p	Silver Mica	350	2	902173	J.M.C. CX22S/350
C19	.01	Ceramic	100		900067	Erie CD801
C20	.0022	Ceramic	350	20	902126	Lemco 310K
C21	7-35p	Variable			908806	Steatite Triko 02/N1500
C22	7-35p	Variable			908806	Steatite Triko 02/N1500
C23	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C24	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C25	10p	Polystyrene	30	2½	908324	Suflex HS7/A
C26	10p	Polystyrene	30	2½	908324	Suflex HS7/A
<u>AGC Board (BC 31466/B)</u>						
C1	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C2	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C3	.0086	Silver Mica	125	2	908337	S.T.C. 454LWA-74
C4	330p	Polystyrene	30	2½	908242	Suflex HS7/A
C5	.047	Polyester	250	20	909227	Mullard AE/P47K
C6	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C7	33p	Polystyrene	30	1p	906497	Suflex HS7/A
C8	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C9	180p	Polystyrene	30	2½	907884	Suflex HS7/A
C10	390p	Polystyrene	30	2½	908243	Suflex HS7/A
C11	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C12	0.22	Ceramic	50	-10+50	908338	T.C.C. CML10
C13	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C14	6.4	Electrolytic	25	-10+50	905371	Mullard C426 AR/F6.4
C15	0.64	Electrolytic	64	-10+50	909311	Mullard C426 AS/H0.64
C16	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C17	50	Electrolytic	25	-10+50	908798	Mullard C426 AR/F50

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
<u>I.F. MODULE (continued)</u>						
<u>Converter Amplifier Board (BC 34783/VAR) (Top Board)</u>						
C1	.0033	Ceramic	50	10		Erie 8003 W5R
C2	330p	Polystyrene	30	2 $\frac{1}{2}$	908242	Suflex HS7/A
C3	82p	Ceramic	50	10		Erie 831 N2200
C4	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C5	470p	Ceramic	50	10		Erie 8003 W5R
C6	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C7	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C8	470p	Polystyrene	30	2 $\frac{1}{2}$	908317	Suflex HS7/A
C9	2.2	Tantalum	20	20	908316	U. Carbide K2R2J20S
<u>Converter Oscillator Board (BC 38568/VAR) (Bottom Board)</u>						
NOTE: Except for C9 the capacitor details are identical for the 100 kHz and 455 kHz versions.						
C1	.047	Polyester	250	20	909227	Mullard C280 AE/P47K
C2	6.8p	Ceramic	750	$\frac{1}{2}$ p	902041	Lemco 310NPO
C3	150p	Polystyrene	30	2 $\frac{1}{2}$	908331	Suflex HS7/A
C4	7-35p	Variable			908806	Steatite 7S Triko 02
C5	470p	Polystyrene	30	2 $\frac{1}{2}$		Suflex HS7/A
C6	0.64	Electrolytic	64	-10+50	909311	Mullard C426 AS/HO.64
C7	0.1	Polyester	250	10	909847	Mullard C280 AE/A100K
C8	470p	Polystyrene	30	2 $\frac{1}{2}$	908317	Suflex HS7/A
C9	18p	(455 kHz board)	30	1p	908323	Suflex HS7/A
C9	100p	(100 kHz board)	30	2 $\frac{1}{2}$	908241	Suflex HS7/A
C10	470p	Polystyrene	30	2 $\frac{1}{2}$	908317	Suflex HS7/A
<u>I.F. Amplifier Board (BC 30533)</u>						
L1		Coil Assembly				Racal CT 33004
L2		Coil Assembly				Racal CT 33005
L3		Coil Assembly				Racal CT 33006
<u>Detector Board</u>						
T1		Transformer Assembly			CT 32961	
T2		Transformer Assembly			CT 33002	
L1		Not used				
L2		Coil Assembly			CT 31473	
L3		Coil Assembly			CT 32962	
<u>A.G.C. Board</u>						
L1		Coil Assembly			CT 33008	
L2		Coil Assembly			CT 33007	

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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### I.F. MODULE (continued)

#### Converter Amplifier Board

L1		Coil Assembly (455 kHz)			CT 32958	
L2		Coil Assembly (100 kHz)			CT 34763	

#### Converter Oscillator Board

L1		Coil Assembly (455 kHz)			CT 32959	
L1		Coil Assembly (100 kHz)			CT 34764	
L2		Coil Assembly (455 kHz)			CT 32960	
L2		Coil Assembly (100 kHz)			CT 34765	

#### Transistors

#### I.F. Amplifier Board

VT1	p.n.p.	909414	Motorola 2N3323
VT2	p.n.p.	906370	Texas 2N2412
VT3	p.n.p.	909414	Motorola 2N3323
VT4	p.n.p.	909414	Motorola 2N3323

#### Detector Board

VT1	n.p.n.	906433	S.T.C. BSY95A
VT2	n.p.n.	900656	Texas 2S733
VT3	n.p.n.	906433	S.T.C. BSY95A
VT4	n.p.n.	906433	S.T.C. BSY95A
VT5	n.p.n.	906433	S.T.C. BSY95A
VT6	n.p.n.	906433	S.T.C. BSY95A

#### AGC Board

VT1	p.n.p.	909414	Motorola 2N3323
VT2	n.p.n.	906433	S.T.C. BSY95A
VT3	n.p.n.	910839	Texas 2N3707
VT4	n.p.n.	909413	S.T.C. 2N930
VT5	p.n.p.	909414	Motorola 2N3323
VT6	n.p.n.	908361	Texas 2N1304

#### Converter Amplifier Board

VT1	n.p.n.	906433	S.T.C. BSY95A
VT2	n.p.n.	906006	Mullard BC107
VT3	n.p.n.	906006	Mullard BC107

#### Converter Oscillator Board

VT1	p.n.p.	909414	Motorola 2N3323
VT2	n.p.n.	906433	S.T.C. BSY95A

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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### I.F. MODULE (continued)

#### Diodes

##### Main I.F. Amplifier

D1		908343	Texas 1S920
----	--	--------	-------------

##### Detector Board

D1		908343	Texas 1S920
D2		908343	Texas 1S920
D3	Not used	( 900652	Mullard AAZ13 or
D4		( 908349	Hughes HD1871
D5	Zener	908344	International MZ13T5
D6		908343	Texas 1S920
D7		908343	Texas 1S920

##### AGC Board

D1		906720	Texas 1S44
D2		908343	Texas 1S920
D3		908343	Texas 1S920
D4	Zener	908344	International MZ13T5

#### Plugs and Sockets

##### I.F. Unit Module Connectors

SKT4	Coax. Fixed I.F. Input	906878	Belling Lee L1403/CS/Ag
PL3	Plug, free, to mate with SKT4	908370	Belling Lee L1403/RFP/Ag
PL1	Main 37-way connector (fixed)	908674	Cannon DCF37P
1SKT1	Free 37-way connector	908603	Cannon DCM37S

##### I.F. Converter Panel

SKT1	Coaxial: fixed	906878	Belling Lee L1403CS/Ag
SKT2	Coaxial: fixed	906878	Belling Lee L1403CS/Ag
SKT3	Coaxial: fixed	906878	Belling Lee L1403CS/Ag

#### Crystals

##### Detector Board

XL1	1601.50 kHz	CD38871/B
XL2	1598.50 kHz	CD38871/C

##### Converter Oscillator Board (8)

XL1	1145 kHz in 455 kHz Converter	CD38871/E
XL2	1500 kHz in 100 kHz Converter	CD38871/F

##### Terminal Strip

TB1	5-way - rear panel.	909928	Carr. Fastener 44-79-593-5M
-----	---------------------	--------	--------------------------------

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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POWER UNIT TYPE PU.1153 (AC/DC SUPPLY)

(BC 38640)

Component Board Assembly

BA37549

Components

NOTE: Components pre-fixed '1' are located on the chassis assembly.  
Those without prefix are on the component board.

Resistors

1R1	100k	Metal Oxide		5	907866	Electrosil TR5
R1	1k	Metal Oxide		5	906031	Electrosil TR5
R2	1.8k	Metal Oxide		5	906026	Electrosil TR5
R3	2.2k	Metal Oxide		5	906020	Electrosil TR5
R4	2.7k	Metal Oxide		5	906347	Electrosil TR5
R5	2.7k	Metal Oxide		5	906347	Electrosil TR5
R6	1.2k	Metal Oxide		5	906346	Electrosil TR5

Potentiometers

1RV1	1.5k				908689	Colvern 1106/98
------	------	--	--	--	--------	-----------------

Capacitors

	µF		volts			
1C1	.02	Paper	350	20	902279	Dubilier Minicap G15
1C2	.02	Paper	350	20	902279	Dubilier Minicap G15
1C3	500	Electrolytic	64	-10+50	906759	Mullard C431 BR/H500
1C4	500µ	Electrolytic	64	-10+50	906759	Mullard C431 BR/H500
1C5	100	Electrolytic	50		900506	Hunts MEFC43AT
C1	100	Electrolytic	6.4	-10+50	911691	Mullard C426 AR/C100
C2	0.1	Polyester	250	20	909428	Mullard C280 AE/P100K

Transformer

1T1	Mains power transformer		USA. D - 01650
-----	-------------------------	--	----------------

Transistors

1VT1	High current: n.p.n.	906371	RCA 2N3055
VT1	p.n.p.	911565	Mullard BCY40
VT2	p.n.p.	911565	Mullard BCY40

Diodes

1D1	Zener: 18 volts	911123	Mullard OAZ234
D1	Encapsulated rectifier unit	909020	Motorola MDA 920/3
D2	Encapsulated rectifier unit	909020	Motorola MDA 920/3
D3	Zener: 6.8V	911120	Hughes HS2068A
D4	Zener: 4.7V	909717	Mullard OAZ240

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part No.	Manufacturer
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PU.1153 (continued)

Fuselinks

1FS1		MAINS 250 mA anti-surge			911700	Beswick TDC134
1FS2		HT. 1 amp. anti-surge			912052	Beswick TDC134
Fuseholders					900412	Belling Lee 1575

Switches

1SA		Slider: panel			912063	E.M.I. Type S5
1SB		Slider: panel			912063	E.M.I. Type S5

Connectors

1SKT1		Socket: sub-miniature 15-way			908683	Cannon DAMF. 15.S
PL1		Plug: fixed 3-pin, brass			900011	Plessey Mk4 CZ63953/5
		Socket, free, for power connection to PL1			905151	Plessey Mk4 2CZ83283/5
		Outlet Accessory Set for free socket			905154	Plessey 508/1/03008/205

RA.1217 MAINTENANCE MANUAL  
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## CHAPTER 1

### DETAILED CIRCUIT DESCRIPTION

#### INTRODUCTION

1. The RA. 1217 is constructed on a modular system, the separate modules themselves being composed of smaller assembly units. This type of construction lends itself to a servicing system based on replacement units and simplifies the incorporation of improved designs or special facilities. Many of the board assemblies contain further coil or transformers sub-assemblies etc., but it is strongly recommended that the user should regard the printed circuit board assembly as the smallest item suitable for unit replacement. In accordance with this principle the receiver can be dismantled into the following main items. Each principal heading indicates a module, with the printed circuit boards contained in that module listed beneath.

#### MODULE ASSEMBLIES

2. <u>Units and Sub-Assemblies</u>		<u>Racal Part Number</u>
<u>R. F. Module Assembly</u>	Fig. 4	CA. 38538/A
1. Aerial Filter		AA. 28188
2. Coil and Switch Assembly		BA. 34082
3. R. F. Amplifier Board		BA. 28185
4. H. T. Filter (not located in the R. F. Module)		AA. 28179/B
<u>1st Mixer and 40 MHz Filter Assembly</u>	Fig. 8	BA. 28211
1. 1st Mixer Board		BA. 28215
2. 40 MHz Filter		AA. 28197
<u>2nd Mixer Assembly</u>	Fig. 9	BA. 30959
1. Mixer Board		BA. 28177
<u>3rd Mixer Assembly</u>	Fig. 11	BA. 35970
1. Mixer and Filter Board		BA. 35966
<u>1st V. F. O. Assembly</u>	Fig. 5	CA. 28120
1. Oscillator Board		BA. 35195
2. Buffer Amp (to 1st Mixer)		BA. 28128
3. Buffer Amp (to Harmonic Mixer)		BA. 32535

## Units and Sub-Assemblies

		<u>Racal Part Number</u>
<u>2nd V. F. O. Assembly</u>	Fig. 10	CA. 28101/B
1. Oscillator Board		BA. 35808
2. Buffer Amplifiers		BA. 35807
<u>1 MHz Amps, Osc. and Calibrator</u>	Fig. 6	(Part of CA. 28276/B)
1. 1 MHz Amplifiers		BA. 32858
2. 1 MHz Osc. and Calibrator		BA. 32860
<u>37.5 MHz Generator</u>	Fig. 7	(Part of CA. 28276)
1. H. T. Filter		BA. 28284
2. Harmonic Generator Board		BA. 32854
3. } Harmonic Filter		BA. 35836
4. }		
5. Harmonic Mixer		BA. 37894
6. 37.5 MHz Buffer Amp.		BA. 32850
** The overall module (CA. 28276) is usually referred to as the '37.5 MHz Generator' module although it also contains the 1 MHz and calibrator section.		
<u>37.5 MHz Band-Pass Filter</u>	Fig. 7	AC. 28192
<u>I. F. Module Assembly (455 kHz i. f.)</u> <u>(100 kHz i. f.)</u>	Fig. 12	DA. 38580/A DA. 38580/B
1. I. F. Amplifier Board		BA. 30533
2. Detector Board		BA. 28236
3. A. G. C. Board		BA. 31466/B
4. Converter Oscillator Board (455 kHz)		BA. 38568A
(100 kHz)		BA. 38568B
5. Converter Amplifier Board (455 kHz)		BA. 34783A
(100 kHz)		BA. 34783B
<u>B. F. O.</u>	Fig. 13	
1. 600 kHz Oscillator Board		BA. 30540
2. Buffer Amplifier Board		BA. 30542
<u>Power Unit PU. 1153 (a. c. /d. c.)</u>	Fig. 15a	
1. Complete Assembly (with Component board)		CA. 38640
2. Component Board Assembly		BA. 37549

## MAIN CHASSIS GENERAL DETAILS

3. Before commencing a detailed description of each module a few points concerning the main chassis may be noted. The most suitable illustrations to refer to are the Interconnections diagrams Fig. 16 and 17. The location of modules in the main chassis is shown in Fig. 18.

### H. T. DISTRIBUTION

4. The -16V h.t. supply from the Power Unit is supplied, without switching, to the 3rd Mixer, 1 MHz oscillator, I. F. Module and B. F. O. The -16V supply to those stages prior to the 3rd Mixer, which are the R. F. Module, 1st Mixer, 2nd Mixer, 1st V. F. O. and 37.5 MHz Generator circuit, is controlled by the System switch. The switched h.t. to these units is routed via the microswitch SB and the terminal block TB1 which enables the switched h.t. to be connected to an external l.f. adaptor unit, if required.

5. The microswitch SB connects h.t. to the terminal 'h.t. r.f.' in all settings of the MHz tuning control except '00'. When the MHz control is turned to display '00' on the scale, a cam moves the micro-switch SB to the opposite contact, thereby transferring the h.t. to the terminal 'h.t. l.f.' on TB1. For operation below 1 MHz the terminals 'h.t. r.f.' and 'h.t. l.f.' can be linked. This link should be removed when the Racal l.f. adaptor is connected.

### System Switch SE

Fig. 16

6. In the OFF position the external supply to the power unit is disconnected by the opening of the switch contacts SC1 and SC2 which are mounted on an extension of the shaft of the system switch SE. The function of each wafer of switch SE is described as follows:

7. Wafer SE2R: This wafer controls the distribution of -16V h.t. to certain circuits as follows: In positions CHECK B. F. O. and CAL, -16V is supplied to the calibrator circuit and disconnected from the units prior to the 2nd Mixer. In the MAN and A. G. C. positions of the switch the -16V is connected to the circuits prior to the 2nd Mixer, and disconnected from the calibrator circuit.

8. Wafer SE1R: In all settings except MAN, this wafer connects the a. g. c. line to the a. g. c. amplifiers in the i. f. module. In MAN. the a. g. c. line is connected to the slider of the R. F. Gain control.

9. Wafer SE3F: This wafer provides an earth connection to the b.f.o. switch (SB1F). In the CAL position the earth is disconnected in order to disable the b.f.o. during the calibration procedure.

10. Wafer SE1R: An earth is provided only in the three a. g. c. positions of the system switch, thus completing the charge path of the appropriate time-constant capacitor in the I. F. Module. The

### Main Chassis (Continued)

contact 'a. g. c. short' is connected to the Bandwidth switch, in order to prevent the use of short time-constant a. g. c. whenever the Bandwidth switch is set to bandwidths of 1.2 kHz, or less.

### Meter Switch

11. In the R. F. position the + terminal of the meter is connected to the a. g. c. output in the I. F. Module and the negative terminal to earth via the slider of the set-zero potentiometer 3RV4. With nil signal input and with the R. F. GAIN control at fully clockwise the a. g. c. line is at approximately 4 volts negative to earth, the meter can be set to zero by adjusting 3RV4. Any subsequent a. g. c. output then provides a meter indication of signal strength. In the A. F. position the meter is connected across the output of the rectifier bridge 3D1-3D4 and indicates the level of the 1 mW 600 $\Omega$  audio line.

### Meter Zero Setting

12. The potentiometer 3RV4 is mounted on a small component board located within the receiver, on the left hand side. (Fig. 18). The setting procedure requires the injection of a 1  $\mu$ V e. m. f. at the antenna socket, with the system switch at AGC Med. and the Meter switch to R. F. The potentiometer is then adjusted to give an 'S' Meter reading of exactly 1 microvolt.

### MHz Tuning Control

13. This control rotates the variable capacitor of the 1st v. f. o. thus providing the electronic band selection described in the Operators Manual.

14. A further function of the MHz control is that when set to indicate '00' a pair of microswitches (1SA and 1SB on Fig. 16) are actuated, which disconnect the a. g. c. and h. t. from the r. f. unit, first mixer, second mixer, first v. f. o. and 37.5 MHz generator and transfers these voltages to alternative terminals on the rear panel marked 'h. t. l. f.' and 'a. g. c. l. f.' from which they may be connected to an l. f. adaptor unit.

### KHz Tuning Control

15. This control rotates the variable capacitor of the 2nd v. f. o. and has no auxiliary functions.

### R. F. Gain A. F. Gain, Line Level

16. These controls are described in the paragraphs headed 'I. F. MODULE'. The circuit connections are illustrated in Fig. 12 and Fig. 16.

## Main Chassis (Continued)

### Cal-Fine Tune Control 1RV3

17. Refer to the paragraphs headed '2nd V. F. O. ' and Fig. 10.

### 2nd V. F. O. Switch

18. Refer to the paragraph headed '2nd V. F. O. ' and Fig. 10. (Page 1.14)

### Plugs and Sockets

19. Several of the modules are connected to the chassis wiring via Cannon connectors which contain both d.c. and r.f. connections. The part of the connector attached to the module is fitted with d.c. pins and coaxial sockets and is described as the plug (PL1). The mating socket (SKT) is attached to the chassis wiring and carries d.c. sockets and coaxial pins. Diagrams of these connectors are shown in Fig. 16 Interconnections.

### Wiring Identification

20. In the main chassis cableform, interconnections can be traced by reference to marker sleeves for coaxial and screened wiring, and colour coding for d.c. wiring. Refer to Fig. L-16 for information. The wire numbering for the Crystal Filter Unit is shown in Fig. 18.

## R. F. MODULE

21. The R. F. Module provides filtering, pre-tuning and amplification of the r.f. signal, with delayed a. g. c. The module consists of three assemblies through which the signal passes in sequence, referring to Fig. 4 they are:-

- (a) From the Antenna input via the Muting relay contact RLAl to the 0 to 30 MHz low-pass filter.
- (b) Antenna attenuation and pre-tuning stage.
- (c) The r. f. amplifier board with a. g. c.

### Wiring Connections

22. Wiring connections to the module are made via pins on the side. In later versions of the module these connections are made via a 5-way connector at the forward end, with only the r.f. outlet to the 1st Mixer remaining on the side.

## R.F. Module (Continued)

### Antenna Input and Filter

23. The antenna is connected to the rear panel socket R.F. INPUT, thence via RL1 and a 500 mA fuse to the antenna filter circuit. A discharge path is provided to protect the antenna circuit against excessive accumulation of static charges, and the 500 mA fuse is a protection against a heavy surge such as might occur if the receiver is inadvertently tuned through the carrier frequency of an adjacent high-powered transmitter. The muting relay RLA can be wired, via a pin on the 12-way outlet on the rear panel, to open the antenna circuit when an associated transmitter is keyed. The filter circuit L1, L2, L3 and C1 to C5 has a passband of 0 to 30 MHz which is designed to prevent any break-through at the 40 MHz intermediate frequency (1st i.f.) or at the image frequency (80 MHz). The filter also prevents radiation of the first v.f.o. frequency from the antenna.

### Attenuator Circuit

24. The switch SB which is operated by the front panel control marked AE ATT introduces attenuation into the signal path in approximately 10 dB steps. In the minimum attenuation position of SB the switch is fully clockwise and the signal passes from IL3 via SB2F to the switch 2SA without attenuation. As the switch is moved anti-clockwise the resistor network R4, R5 and R6 is connected, giving 10 dB attenuation. Subsequent switch settings introduce more resistance into the signal path, thereby providing attenuation levels of -20 dB, -30 dB and -40 dB. To maintain specification for measurements such as cross-modulation, intermodulation etc. at levels above 10 microvolts it is essential to use the AE ATT control.

### R.F. Tuning and Range Selection

25. This circuit comprises the following:-

- (a) R.F. TUNE ganged variable capacitors 2C6a and 2C6b
- (b) The switched r.f. range filters 2L1 to 2L5
- (c) The range switch 2SA which selects either the required range filter or the wideband (WB) path.

26. Range Selection The range selection is in octave steps, 1 to 2 MHz, 2 to 4, 4 to 8, 8 to 16 and 16 to 32 MHz. Wafer 2SA4F selects the primary and 2SA1F the secondary of the filter. Wafers 2SA3B and 2SA2B short circuit all the filters except the one in use. The signal path from the r.f. tuning selection is via 2SA1F to transistor 3VT2 on the r.f. amplifier board.

27. R.F. Tune and W.B. The ganged variable capacitors 2C6a and 2C6b provide tuning of the selected r.f. filter (2L1 to 2L5) under the control of the R.F. TUNE control on the front panel. In the WB setting of the Range switch the input signal by-passes the range



### R. F. Module (Continued)

selection and r. f. tuning circuits and is fed via a 20 dB resistive attenuating network R1, R2 and R3 into the base of transistor 3VT2. The diodes 3D11 and 3D12 provide overload protection against excessive r. f. voltages. (up to 15 volts e. m. f.)

### R. F. Amplifier Board

28. The r. f. amplifier consists of two similar stages 3VT2 and 3VT3 each feeding into a low-pass filter. Considerable attention has been given to filtering and the amplifiers follow conventional practice, except for the method of applying automatic gain control which will be described in detail.
29. A. G. C. Action Consider the amplifier 3VT2. The gain of the amplifier can be varied according to the amount of capacitive by pass applied to the emitter resistor 3R9. The emitter by-pass is via capacitor 3C4 the junction of diodes 3D3 and 3D4 and capacitors 3C2 and 3C3 to earth.
30. The by-pass impedance is determined by the conductivity of the diodes 3D3 and 3D4 and this in turn can be controlled by the amount of d. c. bias applied by the emitter level of the control stage 3VT1. The current through 3VT1 and hence the emitter voltage, is controlled by the a. g. c. voltage applied to the base of 3VT1.
31. Under conditions of minimum a. g. c. action (maximum amplifier gain) the voltage on the a. g. c. line is -4V. This is applied to the base of 3VT1 via 3R3. This causes 3VT1 to conduct heavily and draw the maximum current through the emitter path formed by the chain of diodes 3D1 to 3D4. Under these conditions the impedance of the by-pass from the emitter of 3VT2 is a minimum and amplifier gain is therefore at a maximum. It is essential that the diode chain has a low forward resistance. A high resistance diode could cause a reduction in the maximum gain of the amplifier.
32. Increasing signal strength may cause the a. g. c. voltage applied to the base of 3VT1 to become less negative, as a result the current in 3VT1 decreases and the impedance of the diode path increases, thereby reducing the gain of 3VT2. Under conditions of maximum a. g. c. the level at the emitter of 3VT1 may reach 0 volts but the diodes 3D5 and 3D6 (with 3R5) will ensure that the junction of 3D5 and 3D4 remains at approximately 1.5 volts negative, thus ensuring that the diode chain 3D1 to 3D4 is completely cut off, thereby interrupting the emitter by-pass circuit of 3VT2 and reducing the amplifier gain to a minimum.
33. Temperature Compensation The thermistor 3TH1 in parallel with 3R2 provides temperature compensation. With rising temperature the current in 3VT1 tends to increase. This is counteracted by a decrease in the resistance of 3TH1 which has the effect of taking the

## R. F. Module (Continued)

bias on 3VT1 towards a more positive level, thereby checking the increase in emitter current due to temperature rise.

34. Setting-Up 4RV1. The potentiometer 4RV1 which is mounted on the H. T. Filter board on the underside of the receiver (Fig. 18) is provided to allow for variations in diode characteristics, thus avoiding the necessity for selection or matching of components. Adjustment should be necessary only when putting a new amplifier board into service or following component changes. The setting is quite critical and adjustment should be made strictly according to the procedure given in the alignment chapter. The general principles of the adjustment procedure are as follows:

35. The system switch is set to Manual and the R. F. GAIN control is set to the maximum gain position, thereby causing the a. g. c. line to acquire a level of -4 volts to chassis. A d. c. voltmeter (AVO 8) is connected to the collector of 3VT1 (-ve) on the r. f. amplifier board.

36. Potentiometer 4RV1, should be adjusted so that the collector voltage of 3VT1 decreases (becomes less negative) as the transistor is brought towards saturation. The correct setting is the exact point where the collector voltage just ceases to change, indicating that the transistor has 'bottomed'. The actual reading on the voltmeter at which this occurs will probably be between 3 and 4V negative. A 'bottom' reading greater than -4 volts indicates that the diode chain has a high forward resistance which will be detrimental to amplifier gain. The forward resistance of any diode in the chain should not exceed 25 $\Omega$  when measured on the 'ohms x 100' range of the AVO Model 8 test meter. (Diodes type HS1842)

### FIRST MIXER =====

#### FIRST MIXER (BA. 28211)

Fig. 8

37. A balanced mixer circuit is used to reduce the possibility of the second harmonic of a 40 MHz signal entering the 40 MHz filter. The incoming signal from the r. f. unit is fed into transformer T1 and drives the emitters of VT1 and VT2 in push-pull. The first v. f. o. frequency is applied via PL3 and C4 to the bases of VT1 and VT2. The circuit is balanced by the potentiometer RV1.

38. The mixer output appears in the inductor L1 which is mounted in a sub-assembly with the remaining inductors of the 40 MHz filter, L2 to L8. Each coil has an adjustable core which combined with the critical spacing of the coils determines the response of the filter which has a passband 650 kHz either side of 40 MHz. It is essential that the filter should have a sharp cut-off, particularly on the high frequency side, to prevent the first v. f. o. frequency entering the filter when the v. f. o. is operating at the lower end of its frequency range.

## FIRST V. F. O.

Fig. 5

39. The first v. f. o. consists of three sub-circuits mounted on individual boards. The oscillator is a conventional Hartley circuit tuned by the Megahertz tuning capacitor C1 which is not mounted on the board. The oscillator frequency range is 40.5 MHz to 69.5 MHz. Normally the lowest frequency used is 41.5 MHz when the Megahertz tuning control is set to 01. The oscillator output is taken from a tapping near the earthy end of inductor L1 and fed to two buffer amplifiers in parallel.

40. The two buffer amplifiers are identical circuits, the only difference being that one feeds out via plug PL2 to the first mixer stage and the other via PL1 to the harmonic mixer (37.5 MHz generator). A cascode circuit is employed to obtain adequate buffering, and the circuits are entirely conventional. When removing the 1st V. F. O. module from the chassis the h. t. lead (violet) must be disconnected from the small terminal block beside the module. Some earlier receivers do not have this terminal block, in which case the violet wire must be unsoldered from the H. T. Filter board on the underside of the receiver. (Fig. 18).

### 37.5 MHz GENERATOR MODULE

NOTE: This module contains the following two main assemblies:-

- (a) The 1 MHz Oscillator, Amplifier and Calibrator
- (b) The 37.5 MHz generator assembly consisting of a harmonic generator mixer and amplifier. Refer to instructions in Chapter 7 for obtaining access to this assembly.

The 1 MHz oscillator and the calibrator assembly will be described first.

#### 1 MHz OSCILLATOR AMPLIFIER AND CALIBRATOR

Fig. 6

41. This assembly consists of two sub-circuits. One board contains the 1 MHz crystal oscillator and calibrator circuit, the other board contains the amplifier stages which provide buffering in the 1 MHz input and output circuits. The boards are mounted side-by-side on the upper (hinged) deck of the 37.5 MHz Generator Module. The calibrator is easily identified by the 1 MHz crystal mounted on the board.

#### 1 MHz Oscillator and Calibrator

42. Transistor VT1 is contained in a conventional Pierce type of crystal-controlled circuit. The output is taken from the emitter via the capacitive divider C4 and C5 to provide the correct level at the base

circuits of transistors VT2 and VT3 on the amplifier board. The 1 MHz crystal XL1 is contained in a holder and must be removed if an external 1 MHz reference source (synthesizer) is connected to the receiver.

43. The calibrator circuit is a regenerative divider which receives an input at 1 MHz from the amplifier VT2 and supplies 100 kHz with harmonics via connector A2 to the 3rd mixer board. The divider circuit comprises transistors VT2 and VT3, and the diode mixer circuit D1 to D4.

44. The action of the divider is as follows: The 1 MHz input is applied via R9 to the centre tap on transformer L2. The circuit L2 and C12 is designed to resonate at 100 kHz and any response at this frequency is amplified by VT3 whose collector circuit, L3 and C14, is tuned to 100 kHz. The 100 kHz in the secondary winding of L3 is fed back to the base of VT2 whose collector circuit L1, C10 is tuned to 900 kHz. Thus 900 kHz and 1 MHz are mixed in the diode ring circuit, the difference frequency (100 kHz) is transferred via T1 to the base of VT3 and the divider action becomes self sustaining. The output is taken via diodes D5, D6 and connector A2, to the third mixer module where the required range of harmonics is injected for calibration of the receiver kHz scale.

#### 1 MHz Amplifier

45. Transistors VT2 and VT3 on the amplifier board can be driven by the 1 MHz oscillator or they can be supplied with 1 MHz (via VT1) from an external source such as a synthesizer. The output from VT2 is fed from the junction of R9 and R10 to the connector A3, thence to the rear panel socket '1 MHz OUT'. The 1 MHz from VT2 also goes to the Detector board in the i. f. module to mix with the 600 kHz b. f. o. frequency.

46. Amplifier VT3 has a collector circuit which is modified by R15, C12 and R17 in order to pre-shape the output waveform to obtain a suitable drive for the harmonic generator. The effect of the pre-shaping is to convert one half-cycle of the sine wave to a peaked waveform capable of generating a wide range of harmonics. (see Chapter 4, paragraph 18). Amplifier VT1 buffers the 1 MHz input whenever a synthesizer or external frequency source is connected.

47. The calibrator circuit functions only when the system switch (SE2R Fig. 16) is set to CAL or CHECK B. F. O. In other switch positions the h. t. supply to the calibrator is disconnected. When the calibrator is switched off it is essential that there shall be no leakage of 1 MHz into the third mixer stage. The leakage is prevented by diode D1 in the amplifier board which is reverse-biased in all settings of the System switch except CAL and CHECK B. F. O. In the two latter settings of the System switch the -ve voltage forward-biases D1 which allows 1 MHz to pass to the calibrator. Additional isolation is provided by diode D6 which similarly gates the calibrator output.

## HARMONIC GENERATOR AND MIXER (37.5 MHz GENERATOR) Fig. 7

48. This section consists of six small sub-assemblies which are numbered 1 to 6, the same numbering also being shown on the circuit diagram. The section is contained in the same module as the 1 MHz amplifier and calibrator. The combined module is commonly referred to as the '37.5 MHz Generator'.

### Harmonic Generator (Board 2)

49. The function of this stage is to produce a wide range of harmonics of 1 MHz, which it does by virtue of the pre-shaped 1 MHz input and the special characteristics of the diode D1. The capacitive property of the diode has the effect of producing a very fast edge possessing a high harmonic content which is applied to the base of VT1. The entire range of harmonics (up to at least the 32nd) must be amplified by VT1 without discrimination in favour of any particular frequency. The pre-set capacitor C1 can be adjusted to provide a constant amplitude over the harmonic range, measured at the output (pin 4). The diode D2 is provided as a safeguard against excessive base voltages. A similar diode connection is seen in the 37.5 MHz amplifier (D1 and D2).

### Harmonic Filter (Boards 3 and 4)

50. This is a low-pass filter designed to pass all harmonic frequencies between 3 and 32 MHz but with a sharp cut-off immediately above 32 MHz. The output of the filter is applied to the base of VT1 on the harmonic mixer board.

### Harmonic Mixer (Board 5)

51. A balanced type of mixer circuit is used so that the harmonic spectrum and the input from the first v.f.o. will tend to cancel each other at the output. The harmonic spectrum input is supplied via pin 2 to the base of VT1. The 1st v.f.o. output is supplied via pin 4 to the base of VT2. Mixing takes place in the common collector circuit L1, C7, C8 which is tuned to 37.5 MHz. The output via pin 5 is fed to the cascode amplifier board. The circuit is balanced by potentiometer RV1 by which the bias on each transistor can be adjusted so that the emitter currents are equal. This adjustment is described in Chapter 3.

### 37.5 MHz Amplifier (Board 6)

52. This is a buffer stage in a cascode circuit mounted on board number 6. A cascode circuit is used to provide adequate buffering with a low noise figure. The capacitor C7 provides neutralizing feedback. The collector circuit of VT2 (T1, C4) is tuned to 37.5 MHz and the secondary of T1, is connected to socket SKT1, which mates with plug PL1, on the 37.5 MHz filter unit.

### 37.5 MHz Filter Unit

53. This is a separate unit mounted on the receiver chassis which is connected to the output from the 37.5 MHz amplifier. The filter is designed and set-up to provide a passband of plus or minus 150 kHz centred on 37.5 MHz. The correct alignment of this filter is vital to the satisfactory functioning of the Wadley system. The user is advised not to attempt any adjustment of the filter alignment.

### SECOND MIXER

Fig. 9

54. The second mixer produces the 2nd i.f. by mixing the 40 MHz i.f. spectrum with the 37.5 MHz injection, and selecting the 2 to 3 MHz difference frequency. The stage VT1 and VT2 is a cascode buffer amplifier similar to the buffer circuits in the 37.5 MHz generator module. The 37.5 MHz is supplied via connector A2 and pin 1; the test point TP1 is provided to check the injection level. The stage is neutralized by capacitor C19 and the collector circuit T1 and C3 is tuned to 37.5 MHz. The secondary of T1 forms part of the emitter circuit of the mixer stage VT3. The capacitor C3 is wired to the rear of the printed circuit board.

55. The 40 MHz i.f. is supplied via A3 to the base of VT3. The resistor IR4 terminates the 40 MHz filter. Test points TP3 and TP2 are provided to check the signal and injection levels, respectively. The collector circuit L1 and C8 form part of the 2-3 MHz band-pass filter and is tuned to the difference frequency, which is in fact a spectrum of signals extending from 2 MHz to 3 MHz. The output is coupled via C9 to the remainder of the 2-3 MHz band-pass filter. Signals via an i.f. adaptor unit, which have been translated to the 2 to 3 MHz band, can be fed in via the LF socket on the receiver rear panel via connector A1 and pin 5 to the input of the 2-3 MHz band-pass filter. A panoramic adaptor can be connected to the rear panel socket PAN. This unit examines the spectrum of signals at the collector of VT2. The band-pass filter is terminated by a 39Ω resistor in the 3rd mixer stage.

### THIRD MIXER

THIRD MIXER (BA. 35970)

Fig. 11

56. In the third mixer the 1 MHz spectrum of signal frequencies from the 2nd mixer (2-3 MHz) is mixed with a frequency (3.6 - 4.6 MHz from the second v.f.o. The difference frequency contains the required signal intelligence at a frequency of 1.6 MHz. A 100 kHz input from the calibrator which is supplied via the connector A3 provides harmonics to which the 2nd v.f.o. (kHz) tuning scale can be aligned.

### Signal Input

57. The preceding 2 to 3 MHz band-pass filter (Fig. 9) is connected via socket A4 to the low-pass filter, formed by 1L1, 1C1 and 1C2, which has a cut-off at approximately 5 MHz. The function of the filter is to give additional protection against 6 MHz and 37.5 MHz.
58. The filtered signal spectrum is fed via 1C3 and 1L2 to pin 1 on the mixer board thence via the blocking capacitor C1 to transformer T1 of the diode mixer circuit.

### Calibrator Input

59. Also applied to T1 is the harmonic input from the calibrator, via A3 and the diode 1D1. This input is switched off except when the System switch is at CAL or CHECK BFO but in order to ensure that there shall be no leakage of the fundamental 1 MHz, even though the calibrator is switched off, a suitable negative voltage is developed at the junction of R1 and R2. This reverse biases the diode in the calibrator output.

### Input From Second V. F. O.

60. The variable 3.6 to 4.6 MHz from the second v. f. o. is supplied via the coaxial connector A2 to the band-pass filter formed by L7, L6, L4 and L2 and associated capacitors. Termination is provided by R7 in parallel with the primary of T2. The filter pass-band should extend from 3.6 MHz to 4.6 MHz with a fairly sharp cut-off above and below these limits. The filter is inserted to meet the following requirements:
- (a) The second v. f. o. is a wideband source and it is necessary to exclude the noise generated at the signal frequencies between 2 and 3 MHz, at 1.6 MHz, and also at the image frequencies of 5.2 MHz and 6.2 MHz.
  - (b) If two receivers are connected in a master-slave relationship using a common 2nd v. f. o., the filter will prevent cross-talk arising from coupling between the respective 2 to 3 MHz circuits which could occur via the 2nd v. f. o.
61. The input from the second v. f. o. is applied via T2 to the bases of the balanced amplifier stage VT1 and VT2. Note the test point TP2. The collectors of VT1 and VT2 are connected via R6 and R9 to the transformers T1 and T3 respectively in the diode mixer circuit.

## Mixer Circuit

62. The mixer circuit consists of the diode ring D1 to D4 together with transformers T1 and T3. This type of mixer is selected for its linearity which cancels the 'odd order' mixing which tends to occur where the input spectrum has a fairly wide bandwidth (in this instance 2-3 MHz) and the i. f. output (1.6 MHz) almost comes within the input spectrum.
63. The sum and difference frequencies from the mixer are fed via T3 into the filter formed by L3 and L5 with C3, C5 and C6. This is a wideband filter centred on 1.6 MHz. Note the test point TP1 at the input to the filter. Associated with this test point is provision for connecting a 68 $\Omega$  resistor for test purposes only. The 68 $\Omega$  resistor is connected when aligning the filter to ensure that the coupling factor between L3 and L5 is less than unity. This alignment is done at the factory and should not normally be attempted by the user.
64. The amplifier VT3 provides the output required to drive the i. f. unit. The 1.6 MHz output from the collector is taken via C12 and the coaxial connector A1 to the bandpass filter FL1, thence to the 1st i. f. amplifier unit. The resistor R14 matches the input impedance of the filter.

## 1ST I. F. AMPLIFIER UNIT

### 1ST I. F. AMPLIFIER UNIT

Fig. 11

65. This is a small unit containing a single stage serving as a buffer between the crystal bandpass filter FL1 and the subsequent crystal bandpass filter selected by the bandwidth switch. The circuit is illustrated on the right hand side of Fig. 11. The wideband tuned inductor L1 is tapped to provide separate outputs having impedances of 100 $\Omega$  and 1 k $\Omega$  respectively. The 1 k $\Omega$  output feeds the subsequent filters (Fig. 16) and the 100 $\Omega$  output is used for reception in the widest setting of the I. F. BW switch without further filtering. The core of L1 is adjustable via a hole in the side of the container.

## SECOND V. F. O.

### General

Fig. 10

66. The second v. f. o. assembly consists of an oscillator driving two wideband buffer stages. The oscillator can be tuned over the range 3.6 to 4.6 MHz by the KHz tuning control of the receiver, also, fine variations of tuning can be made by the FINE TUNE control. Two outputs are provided, one to the 3rd mixer and the other for external use. (2nd V. F. O. OUT). The oscillator stage can be switched off by setting the front panel 2nd V. F. O. switch to EXT which permits the receiver kilohertz tuning to be determined externally by either a synthesizer or the 2nd v. f. o. of a master receiver.



### Oscillator Stage

67. The oscillator VT1 works into a tuned collector circuit comprising the inductor L2, and the KHz tuning capacitor C1 with its associated preset trimming capacitor. These tuning components are mounted on a separate sub-assembly. The oscillator tuning can also be shifted by the variable capacitance diodes D1 and D2. The junction of the diodes is connected via PL1 pin 1 to the CAL-FINE TUNE potentiometer 1RV3, which provides a variable -ve voltage which can shift the 2nd v.f.o. frequency by approximately 8 kHz over the full range of the control.

68. The remainder of the oscillator circuit is conventional. The diodes D1-D4 provide d.c. stabilization against possible variations in h.t. voltage arising from extreme temperature changes affecting the power unit. The oscillator output is taken from the junction of the coupling network R7 and R8 which minimizes any loading effects on the oscillator tuned circuit.

69. The oscillator h.t. supply is connected to pin 5 via the 2nd V.F.O. switch which is mounted on the front panel of the receiver. When this switch is set to INT the 2nd v.f.o. is in operation and an output is available for external use if required. When the switch is set to EXT the oscillator h.t. supply is disconnected and the 2nd v.f.o. frequency for the receiver must be fed in from an external source, such as a synthesizer or master receiver. The external frequency is switched by the gating diodes on the buffer amplifier board.

### Buffer Amplifier Board

70. The diodes D2 and D3 enable the user to switch from internal 2nd v.f.o. to an external source, and vice versa, without the changing or removal of cable connections.

71. When the oscillator stage is running, the diode D2 on the amplifier board is forward-biased by the negative supply which is connected through the 2nd V.F.O. switch (INT position) thence via pin 5 on PL1 and R2 to the diode. This allows the oscillator output to pass via D2 to the amplifier VT1. At the same time the diode D3 is reverse-biased, thus isolating the external input.

72. When the 2nd V.F.O. switch is set to EXT the negative supply is disconnected from pin 5 and connected instead to pin 4 of PL1 whence it is applied via R4 as a forward bias to diode D3. The external input can now pass via A1, C2 and D3 to the amplifier VT1. The resistor R6 (75 $\Omega$ ) terminates the input connector. In this condition diode D2 is reverse-biased thus isolating the oscillator circuit from the amplifier board.

73. The transistors VT1, VT2 and VT3 are wideband buffer stages which provide suitable output levels from the collector circuits. The output from the collector of VT2 is connected via C6 and socket A2 to the 3rd mixer, the resistor R18 provides the required 1 k $\Omega$  source impedance

to the bandpass filter on the mixer board. The external output is taken via C9 from the collector of VT3, the resistor R22 providing the required 75 ohm source impedance for the connector.

### B. F. O. ASSEMBLY

Fig. 13

74. The B. F. O. assembly consists of the DET - B. F. O. switch assembly and variable tuning capacitor, together with a 600 kHz oscillator board and a buffer amplifier. The b. f. o. frequency can be adjusted in fixed steps by the positions +6 to -6 of the DET-B. F. O. switch SB and varied by the fine tune capacitor C2 which is controlled by the central knob of the B. F. O. TUNE control. Switch SB has certain other functions which are described in a later paragraph.

#### 600 kHz Oscillator Board

75. The oscillator VT1 is tuned by the inductor L1 and the variable capacitor C2. In parallel with C2 are four preset capacitors C2, C3, C5 and C6 which are connected in the +3, 0, -3 and -6 positions respectively of switch SB2F, each one providing a progressive reduction of oscillator frequency in 3 kHz steps. The oscillator is initially set-up with the DET B. F. O. switch set to position '+6' and the variable control C2 set to its mid-travel position. The core of L1 is then adjusted to provide an output at 606 kHz. In each of the subsequent switch positions (+3, 0, -3, and -6) the appropriate capacitor C2, C3, C5 or C6 is adjusted to give the required frequency. The oscillator output is taken from the junction of R1 and R2 which provides a low-level input to the buffer amplifier.

76. The negative h. t. supply to the amplifier and oscillator is permanently connected, but the positive (earth) side of the supply to the 600 kHz oscillator stage is connected via pin 5 and the +6 to -6 positions of switch wafer SB1F thence via a wafer on the System switch to earth. In the switch positions LSB, USB and A. M. the earth is disconnected from the b. f. o. thus switching off the 600 kHz oscillator.

#### DET B. F. O. Switch SB

77. The function of each wafer will be described briefly.

78. SB1F: The wiper contact (tag 9) is connected to earth in all positions of the system switch except CAL. (Thus ensuring that the b. f. o. is switched off during the calibration procedure). The LSB and USB positions of SB1F connect the earth to the detector board (i. f. module) where it serves to connect the appropriate crystal for the s. s. b. off-set oscillator.

79. SB1R: In the A. M. position of the DET B. F. O. switch an earth is made to pin 2 of the Detector board (i. f. module) in order to connect the a. m. detector.

80. SB2F: Contacts 2 to 5 which correspond to switch settings +3 to -6 connect the preset capacitors C2, C3, C5 and C6 respectively across the b.f.o. tuned circuit.

81. SB2R: In every switch position except A. M. an earth is made to pin 3 of the Detector board (i.f. module) in order to connect the product detector circuit.

#### B. F. O. Buffer Amplifier Board

82. This amplifier is designed mainly to buffer the b.f.o. from the Detector board circuits. The output is taken from the secondary winding of T1 which provides the low impedance required by the mixer in the Detector board. The adjustable core of T1 together with C2 tunes the output, and R5 ensures sufficient bandwidth to accept the plus or minus 8 kHz variation of b.f.o. frequency. Note that the screen of the cable from T1 secondary, which feeds the 600 kHz b.f.o. frequency to the i.f. module must not be earthed, because it constitutes a part of the base-emitter circuit of transistor VT5 in the Detector board.

#### I. F. BANDWIDTH SWITCHING

83. Provision is made for the fitting of five crystal bandpass filters, FL1 to FL5. The actual number and specification of the filters fitted is stated in the Technical Specification at the front of this Manual. The filter switching is illustrated in Fig. 16. The widest i.f. bandwidth is determined by FL1. The standard receiver also incorporates FL3 and FL4; the additional filters FL2 and FL5 can be incorporated at customers option. The bandwidths are switched by the I. F. B. W. control which operates the switch SA1F to SA4R illustrated in Fig. 16. This switch also selects the a.g.c. time constants to suit the bandwidth selected.

#### Bandwidth Switch

Fig. 16

84. The input to the 1st I. F. Amplifier is filtered to the widest available bandwidth by the filter FL1. (Fig. 11). Two outputs are taken from the 1st I. F. amplifier. The 100 ohm output via 2R1 (Fig. 16) goes to switch wafer SA3F without further filtering. The 1000 ohm output goes via SA1F and SA1R to the selected filter, FL2 to FL5, then to the wafers SA3F and SA3R. The filters are terminated by resistor 2R4. The 1.6 MHz output is fed via plug 1PL3 to the socket SKT4 on the main I. F. Module (Fig. 12).

85. A. G. C. Over-ride. It is the function of the wafer SA2 (Bandwidth switch Fig. 16) to ensure that the short time-constant a.g.c. cannot be used whenever the I. F. B. W. control is set to select the filters FL1 or FL2. If the System switch is set to 'A. G. C. Sh' the Bandwidth switch over-rides this setting and substitutes "medium time-constant", as follows:

86. The required a. g. c. time-constants are selected by the connection of an earth to the appropriate time-constant capacitor in the a. g. c. board of the i. f. module. This earth connection is made by contacts on the System switch wafer SELF. The short time-constant path is connected to the System switch (tag 2) via the wafer SA2R of the Bandwidth switch. When the filters FL1 or FL2 are selected, the 'a. g. c. short' earth line is connected via SA2F tags 1 or 2, to the medium time-constant capacitor in the a. g. c. board. In the remaining positions of the Bandwidth switch the the 'a. g. c. short' connections are normal. To sum up; 'long' and 'medium' a. g. c. is available in all settings of the I. F. B. W. control, but a. g. c. short is confined to the settings 3 kHz and above.

NOTE: The above description refers to the standard bandwidths. Any modification to suit a customers special requirements will be described in an Appendix to the handbook.

### I. F. MODULE

87. The I. F. Module contains the following printed circuit boards, illustrated in Fig. 12.

- (a) I. F. Amplifier Board.
- (b) Detector Board.
- (c) A. G. C. Board.
- (d) I. F. Converter Oscillator Board.
- (e) I. F. Converter Amplifier Board.

### CONNECTIONS

88. The 1.6 MHz i. f. from the bandwidth switch is fed into the i. f. module via the coaxial connector SKT4 at the forward end of the module. All other connections to the receiver are via the 37-way connector 1SKT1. Details of the 37-way connections are shown in Fig. 16. External connections are made via the coaxial sockets, SKT1, SKT2 and SKT3 and the terminal block TB1 mounted on the module and accessible at the rear of the receiver. These outlets are shown in Fig. 12.

### I. F. AMPLIFIER BOARD

Fig. 12

89. The three amplifiers VT1, VT3 and VT4 employ conventional pre-tuned collector circuits with damping resistors R4, R16 and R20 respectively, to ensure a wide bandwidth. A moderate amount of stabilizing feedback is applied to each stage by an un-bypassed resistor in each emitter circuit. The transistor VT2 together with the diode D1 and associated components form part of the a. g. c. system and will be described in more detail.

## I. F. MODULE (Continued)

90. The transistor VT2 is connected in the emitter circuit of VT3 and is in effect a variable feedback device which determines the gain of VT3 under the control of the a. g. c. voltage. The a. g. c. voltage is fed in at pin 3 and via R9 to the base of VT2. Consider first the state when the signal is weak. The a. g. c. line will be at its maximum negative level. This causes VT2 to saturate and offer a low impedance, thus reducing the amount of un-bypassed resistance in the emitter circuit of VT3, resulting in higher gain.

91. Increasing signal strength causes the a. g. c. level to become less negative, and VT2 conducts less heavily, thus increasing the resistance in the emitter circuit of VT3 which results in lower gain. The combined effect of D1 with R7, R8 and R9 is to modify the characteristic of VT3 so that the curve of amplifier gain plotted against change of a. g. c. volts is less abrupt, thus improving the stability of the circuit.

92. The 1.6 MHz output from VT3 is taken from two tapplings on L2. One output is taken via C11 to the buffer amplifier VT4. This stage is similar to the preceding amplifiers but is provided with an additional hum-filtering capacitor C14. The other output from L2 goes to a 1.6 MHz amplifier on the A. G. C. Board. The circuit description will continue by tracing the signal path as it leaves the i. f. amplifier via C16 and pin 5 en-route to the Detector Board.

## DETECTOR BOARD

93. The Detector board contains the a. m. and product detectors, also the offset crystal oscillator for s. s. b. reception. The a. m. detector operates only in the A. M. position of the DET-B. F. O. switch and the product detector operates in all the remaining positions. The switching of these circuits depends upon the biasing of various diodes.

### A. M. Detector

94. In the A. M. position of the DET-B. F. O. switch +ve h. t. (earth) is applied via pin 2 and R8 to resistor R3 and diode D2. This forward biases the diode thus completing the collector circuit of VT2. At the same time the current through R3 saturates VT1 thus completing the emitter circuit of VT2, via R6, VT1 and R5. The diode D1 is reverse biased by the negative rail connection via the path R4, R11, R19 and R18. Hence VT2 acts as a conventional 1.6 MHz amplifier with the collector circuit tuned by the inductance of T1 with capacitor C1.

95. The 1.6 MHz signal appears in the secondary windings of T1. The signal across pins 1 and 6 of T1 is detected by the diode D4 the load being formed by R11, R19 and R18. The detected signal is filtered by C6, L2 and C8, and passed via C9 to the audio emitter-follower VT3. Thence via C7, pin 8 and PL1 pin 7 to the A. F. GAIN potentiometer. A detector output is taken from pin 8 on the Detector board to pin 5 of the

## I. F. MODULE (Continued)

terminal block TB1 at the rear of the receiver to drive a loudspeaker amplifier or tone converter etc.

96. It will be noted that the output circuit of the b.f.o. amplifier VT4 is connected to the emitter circuit of VT2. Whenever the a.m. detector is in operation, a contact on the DET-B.F.O. switch cuts off VT4 to ensure that the signal-to-noise ratio is not degraded by noise injected from this source.

### Product Detector

97. The product detector utilizes the circuit of VT1 and VT2 but with certain changes achieved by diode biasing. Due to the setting of the DET-B.F.O. switch (all positions except A.M.), pin 2 is open circuited and pin 3 is connected to earth. A -ve voltage is applied via R9 and R8 which cuts off VT1 via R3, and reverse biases D2. Thus, with VT1 cut off, the emitter path of VT2 is through R5, the secondary winding of T2, R7 and R6. The earth on pin 3 supplies h.t. + through R11, R4 and D1 to complete the supply to VT2, at the same time it disables the a.m. detector by a reverse bias on D4. The output from the b.f.o. amplifier VT4 via the secondary of T2 is supplied to the emitter circuit of VT2, and the 1.6 MHz signal from the i.f. amplifier board is supplied to the base of VT2. The product detector output is taken from the junction of R4 and R11. This audio output then follows the path described for the a.m. detector.

### S.S.B. Offset Oscillator

98. Transistor VT6 on the Detector board is a crystal oscillator stage which operates in the L.S.B. and U.S.B. positions of the DET-B.F.O. switch, provided the system switch is not set to CAL. (In the CAL position all b.f.o. circuits are disabled to prevent interference with the calibration procedure).
99. The oscillator frequency is determined by the crystal XL1 (DET-B.F.O. switch set to L.S.B.) or by XL2 (DET-B.F.O. switch set to U.S.B.) according to whether the oscillator is to run 1.5 kHz above or 1.5 kHz below, the 1.6 MHz i.f. Each crystal has a preset capacitor in parallel (C21 and C22) for alignment purposes.
100. When the DET-B.F.O. switch is set to U.S.B. and the System switch is set to any position except CAL, +ve h.t. is connected via plug PL1 to pin 15 on the Detector Board and through R32 to the diode D7. This forward biases D7 which conducts, thereby completing the crystal circuit for VT6 which oscillates at the frequency of XL2. Crystal XL1 remains open circuited by the reverse bias on diode D6 due to the negative rail connection. In the L.S.B. position of the DET-B.F.O. switch the forward bias is removed from D7 and applied to D6 via R33, thus connecting XL1. Diode D7 reverts to the reverse biased condition. The oscillator output is taken from the emitter of VT6 and fed from the capacitive divider C18 and C19 which via R24 provides the correct impedance into the base of the mixer VT5.

## I. F. MODULE (Continued)

101. This stage operates as an amplifier when the DET-B. F. O. switch is set to the L. S. B. and U. S. B. positions, and as a mixer in all positions from +6 to -6. The function of the mixer is to combine the 1 MHz from the receiver crystal source with the variable 600 kHz from the b. f. o.

102. Mixer Action. The emitter of VT5 is connected via plug PL1 to the output winding of the 600 kHz transformer in the b. f. o. assembly. Thus, whenever the DET-B. F. O. switch is set to any of the positions from +6 to -6, the b. f. o. frequency is supplied to VT5. It should be noted that the screen of this connection is the return path of the emitter-to-base circuit of VT5 and must not be earthed. The base of VT5 is connected via C17 and plug PL1 to the receiver 1 MHz crystal source. The output from VT5, which is 1.6 MHz plus or minus any variation applied by the B. F. O. fine tuning control is taken via the tapping on L3 to the amplifier VT4.

103. Amplifier Action. When the DET-B. F. O. switch is set to L. S. B. or U. S. B. the 600 kHz b. f. o. frequency is removed and VT5 amplifies the crystal frequency 1601.50 or 1598.50 kHz fed in from VT6 and passes it via L3 to VT4.

### Amplifier VT4

104. This is a conventional amplifier with stabilizing feedback provided by R16. The collector circuit is tuned by T2 and C12, and damped by R17 to ensure sufficient bandwidth. The output from T2 secondary is connected to the emitter circuit of VT2. When the DET-B. F. O. switch is set to A. M. it is necessary to cut off VT4 to prevent noise reaching the emitter circuit of VT2; this is done by disconnecting R19 from earth at the b. f. o. switch SB2R (Fig. 13)

## A. G. C. BOARD

105. The a. g. c. board contains two amplifiers operating at 1.6 MHz, followed by the a. g. c. detector and d. c. amplifier feeding into the time-constant circuits. The remainder of the board is concerned with providing d. c. amplification and manual gain control facilities etc. Provision is made for connecting the a. g. c. circuit to a companion receiver in dual diversity operation.

### Amplifier VT1

106. This is a 1.6 MHz amplifier tuned by L1 in the collector circuit. The input at 1.6 MHz is applied via C1 to the base of VT1 and separate outputs are taken from tapplings on L1. The output via C5 is at a level of 100 mV for external use and is connected, via pin 3 to the 1.6 MHz OUT socket at the rear panel of the receiver. The output via C4 is fed to the base of VT2 and also to the converter board via pin 4. It is reduced in level by the capacitive divider formed by C4 with C3. This arrangement is necessitated by the requirement to obtain two different levels from the one output circuit.

## I. F. MODULE (Continued)

### Amplifier VT2

107. Transistor VT2 is a 1.6 MHz amplifier with a collector circuit tuned by L2 with C9. The inductor L2 is connected as a step-up transformer so that the stage presents a high impedance to the a. g. c. detector.

### A. G. C. Detector

108. The amplified 1.6 MHz from VT2 is coupled to the a. g. c. detector D1 via C10. The components R13, R14, C12 and C13 form an r. f. filter between D1 and the emitter-follower VT3.

### A. G. C. Output

109. Under weak signal conditions current flows in VT3, causing a voltage drop across R15 which reverse-biases the diodes D2, and D3 via the time-constant network C14, C15, C16, R16, R17 and RV1. The a. g. c. output voltage at pins 14, 15 and 16 will be at its maximum negative level.

110. An increase in signal strength will cause the voltage at the base of VT3 to become more negative and less current will flow in R15. The diodes D2 and D3 become forward-biased, leading to a fall in current through VT4, therefore the voltage across R21 will be less negative. This causes a change of current in VT5. The output of VT5 is coupled to the emitter-follower VT6 via the System switch wafer SE1R (all settings except MAN). In the MAN setting of the System switch the a. g. c. level from VT5 is disconnected, and a variable -ve voltage, obtained via the R. F. Gain potentiometer 2RV2, is used to manually bias the a. g. c. line which controls the i. f. and r. f. amplifier stages.

111. The final a. g. c. output is taken via three parallel paths from the emitter of VT6. The output at pin 15 is used within the i. f. unit to control the 1.6 MHz amplifier. The output from pin 14 goes via PL1/1SKT1 pin 34, to the microswitch 1SA (Fig. 16) and from pin 16 the output is fed via the Meter switch (R. F. setting) to the 'S' meter on the receiver front panel.

112. The a. g. c. line voltage from an associated dual-diversity receiver or i. s. b. adaptor can be connected to the junction of diodes D2 and D3 via, pin H on the 12-way socket at the rear of the receiver, thence to pin 6 on the board.

### I. F. Converter

113. Although the i. f. converter circuitry is mounted on two separate boards it should be regarded functionally as one circuit. Two types of converter are available but only one is fitted to a particular receiver, one produces a 455 kHz output and the other a 100 kHz output. The circuit differences are confined to the oscillator crystal frequency, coils L1 and L2 on the oscillator board and the values of components R12 and C9. Resistor



## I.F. MODULE (Continued)

R10 on the amplifier is not fitted to the 455 kHz version. Refer to NOTE 1 on Fig. 12.

114. The output of the crystal oscillator VT1 on the Converter board is fed via C3 and pin 3 to the amplifier VT1 on the amplifier board. The output from the amplifier returns via pin 4 to the emitter of the mixer stage VT2. The signal input at 1.6 MHz is applied via pin 5 to the base of VT2. The circuit L1, C8, C9, C10 and L2 provides filtering at the required i.f. Resistor 12 and capacitor C9 determine the passband, the values shown are for the 100 kHz version.

115. The mixer output is taken from a tap on L2, and via pin 7 to the amplifier board where it feeds into the base of VT2 which is part of the d.c. coupled two-stage amplifier VT2 and VT3. The direct coupled amplifier has overall feedback via R9 which gives a very low impedance at the input to V2 and contributes to the excellent thermal stability. The amplifier also has good linearity which minimises problems which might otherwise arise from intermodulation products.

116. The output circuit of VT3 (L1 and C8) is pre-tuned to the appropriate i.f. (455 kHz or 100 kHz). The resistor R10 is inserted only on the 100 kHz converter in order to off-set the higher 'Q' of L1 at the lower frequency. From a tap on L1 the output goes to the coaxial socket SKT2 on the rear panel. This socket will be engraved either 455 kHz or 100 kHz, according to the type of converter board which is fitted to the i.f. unit. It should be noted that the required termination is 50Ω for the 455 kHz and 75Ω for the 100 kHz converter.

117. If the RA.1217 is connected to a suitable frequency synthesizer, channel oscillator or master receiver, the production of the final i.f. can be locked to the external source by a frequency injected in lieu of the crystal XL1. When an external source is connected, the crystal XL1 must be removed from its socket. For the 100 kHz i.f. a frequency of 1.7 MHz may be supplied to the 1.7 MHz IN/OUT socket:

118. The RA.1217 may be used in a master-slave relationship with another receiver. For this purpose the crystal oscillator frequency is fed to the slave receiver via the socket 1.7 MHz IN/OUT (455 kHz IN/OUT).

c

## AUDIO AMPLIFIER BOARDS

### Alternatives

119. The standard RA.1217 receiver is fitted with a 10 mW audio amplifier board, but a one-watt board is available at customers option. It should be noted that there are restrictions on the amount of -16 volt power available from the power unit for external use when the one-watt board is fitted.

### 10 mW Audio Amplifier Board

Fig. 14a

120. The amplifier board contains two separate amplifiers. The circuits are conventional and will therefore be described only briefly. The a.f. output at the Detector board is taken via the slider of the A.F. GAIN control to the base of the driver transistor VT1. Input capacitors C2 and C3 are in parallel so that l.f. attenuation can be provided by the removal of C3, if desired. Negative feedback is provided by R3. The push-pull stage VT2 and VT3 operates in class A in order to eliminate the need for any setting-up adjustments; negative feedback is applied by R9 and R10. The 10 mW 600 ohm output is supplied to the PHONES jack socket on the front panel and also to the outlets at the rear panel.

121. The line amplifier VT4 is supplied with an a.f. signal via the slider of the A.F. Level pre-set control. The additional input capacitor C10 may be removed if attenuation of the a.f. input is required. The 1 mW output is taken from the secondary winding of transformer T3 to the meter diodes and to a pair of pins at the rear panel outlet.

### One-Watt Amplifier Board

Fig. 14b

122. The one-watt board contains two separate amplifiers:

- (a) A one-watt push-pull section comprising transistors VT1 to VT5 suitable for driving an external 15 ohm loudspeaker.
- (b) A low powered section (VT6 to VT8) which provides 1 mW into the transformer 1T1 for connection to an external 600 ohm line.

123. The one-watt amplifier is a transformerless push-pull circuit employing the principle of "complementary symmetry". The audio input from the signal detector is applied via the A.F. Gain potentiometer to the base of transistor VT1, which serves as a driver to the transistors VT2 and VT3. The bases of VT2 and VT3 are directly coupled to the collector circuit of VT1 and current variations in the circuit RV2, D1, D2, R1 and R2 will vary the base potentials of VT3 and VT2.

124. Transistor VT2 is an n.p.n. transistor which functions as an emitter-follower for positive-going inputs, while at the same time VT3 is cut off. On a negative-going input VT2 will cut off and the p.n.p. transistor VT3 will conduct, thus giving push-pull operation. The output transistors VT5 and VT4 are d.c. coupled to VT3 and VT2 respectively. It should be noted that transistors VT4 and VT5 are mounted in holders adjacent to the board and must be carefully released when removing the board from the chassis.

125. In the static condition the junction of R7 and R8 is at a potential which is half the supply voltage (i.e. at -8V). A variation in the current in VT4 and VT5 will produce a varying voltage at this junction, which via capacitor 1C12 drives the loudspeaker. Under static conditions the amplifier is balanced by means of potentiometer RV1 which permits accurate adjustment of the half-supply voltage at the junction of R7 and R8 (pin 5).

126. A.F. negative feedback is provided by capacitor C1 and to limit the frequency response a low value capacitor C3 is connected between collector and base of VT1. The diodes D1 and D2 provide temperature compensation to balance the effects of temperature change on the base-emitter junctions of VT2 and VT3. The potentiometer RV2 permits adjustment of the quiescent bias conditions of VT2 and VT3.

127. Adjustments. With no audio input connect a d.c. voltmeter to pin 5 (-ve) and chassis (+ve). Adjust RV1 for a reading of -8 volts. To adjust RV2 the -16V (violet) wire must be unsoldered from pin 6 and a milliammeter connected in series. RV2 is then adjusted for a reading of 55 milliamps. Re-connect the -16V lead and then re-check the -8 volt reading at pin 5. Re-adjust RV1 if necessary.

#### 1 mW Amplifier

128. The 1 mW section follows conventional practice. The input from the signal detector is applied via the A.F. Level potentiometer and pin 7 to amplifier VT6 which is coupled via an emitter-follower VT7 to the output transistor VT8. The capacitor C7 is inserted to limit the frequency response.

## POWER SUPPLY MODULES

129. The standard type of power module is the PU.1153. The unit consists of a main assembly to which is attached a printed circuit board containing the stabilizer circuitry. Referring to Fig. 15a, the components mounted on the assembly are prefixed '1'. Those references without a prefix are located on the printed circuit board.

### INPUTS

130. The PU.1153 can operate from the following supplies:

- 100-125 volt a. c. 45-400 Hz single phase
- 200-250 volt a. c. 45-400 Hz single phase
- 21- 27 volt d. c. with positive earth

### OUTPUTS

131. -16 volt (regulated) 400 milliamps  
-20 volt (unregulated) 200 milliamps. Generally,  
this level will be approximately 24 volts.

### SWITCHES

#### AC/DC Switch

132. A locking plate displays the type of power input, either 'A. C.' or 'D. C.' If the indication is not correct, remove the locking plate (one screw) set the switch in the alternative position and replace the locking plate in the reversed position so that the correct indication is displayed. This switch must be correctly set before switching on the receiver.

#### Voltage Selector Switch

133. This switch is in use when the A. C. /D. C. switch is set to A. C. It should display the correct a. c. supply voltage range, either 115 or 225. If the setting is not correct remove the locking plate, reset the switch and replace the locking plate in the reversed position so that the correct voltage range is indicated.

## POWER SUPPLY MODULES (Continued)

### FUSELINKS

134. Two fuse links are provided. The 250 mA MAINS fuse is in circuit whenever the A.C./D.C. switch is set to A.C. The 1 amp H.T. fuse is in circuit on both A.C. and D.C. supplies. Replacement fuses must be of the anti-surge type.

#### Replacement Fuselinks

135.	MAINS	250 mA	Beswick	TDC 134
	H.T.	1 amp	Beswick	TDC 134

### POWER CONNECTIONS

136. The external power supply is connected via a 3-core power cable to which a suitable 3-pin connector should be fitted: for an a.c. supply connect the red lead to line; black to neutral and green to the earth (ground) pin. For a d.c. supply connect the red lead to +ve and the black lead to -ve. The free socket for connecting the power cable to the receiver plug is a Plessey MK.4 2CZ83283/5 with accessory set 508/1/03008/205.

### ADJUSTMENTS

#### -16 Volt Output

137. The potentiometer 1RV1 on the power unit should be adjusted to provide an output of -16 volts relative to chassis. A suitable measuring point is the terminal H.T. R.F. on the rear panel of the receiver.

#### Dimmer Resistance: Dial Lamps

138. The setting of the dimmer potentiometer 1RV2, which is accessible at the front panel of the receiver may be set by the user to provide a suitable level of illumination.

### CIRCUIT DESCRIPTION PU.1153

139. The external power supply which enters the module via the 3-pin connector is routed via the receiver ON/OFF switch and returns to the module via pins 15 and 13 of the 15-way connector 1SKT1.

140. In the A.C. setting of switch 1SB, the a.c. power is fed to the primary windings of transformer 1T1. The switch 1SA connects the windings in parallel for 100-125 volt input, or in series for 200-250 volt input. In the D.C. setting of switch 1SB the +ve d.c. input is connected to the 0 volt output, and the -ve input to the regulator transistor and to the unregulated -20 volt output.

## POWER SUPPLY MODULE (Continued)

141. The fuse IFS1 (Mains) protects the input to the transformer, the other fuse IFS2 (H.T.) is common to both a.c. and d.c. inputs to the bridge rectifiers D1 and D2. The rectified output from D1 is fed to the stabilizer board and the output from D2, which is normally in the range 20 to 24 volts, is fed without stabilization to a pin on the 12-way outlet at the rear of the receiver.

142. The capacitors 1C1 and 1C2 serve as an r.f. filter. The resistor 1R1 is provided to discharge the capacitors when the power is switched off.

### Stabilized D. C. Circuit

143. The output from the bridge rectifier D1 is fed to the filter capacitor 1C3. The transistor 1VT1 completes the connection to the -16 volt output line, and stabilizes the output by acting as a series regulator under the control of the d.c. amplifiers VT1 and VT2. The output can be set to -16 volts by adjustment of the potentiometer 1RV1.

144. The emitter of VT2 is held at a constant voltage by the zener diode D3. The level at the base of VT2 is determined by the setting of 1RV1 and also by any change of voltage occurring in the chain R4, 1RV1 and R5 due to a change in output load. For example, if an increase in output loading causes the voltage at 1RV1 to go less negative and the collector current in VT2 decreases. This causes a change in the base current of the beta multiplier VT2 which in turn increases the output of 1VT1 so as to maintain a constant output voltage.

145. To allow the stabilizer to operate from a wide range of input voltages the network R1, R2 and R3 together with the zener diode D4 provide input regulation. The diode D4 holds the junction of R1 and R2 at a constant 4.7 volts, thus clamping the base of VT1 at a constant level despite changes in input voltage. The electrolytic capacitor C1 eliminates ripple.

## CHAPTER 3

### PERFORMANCE CHECKS

#### INTRODUCTION

1. The instructions in this chapter provide a series of checks on receiver performance suitable for use subsequent to an overhaul, or in the event of adverse reports on receiver performance. Suitable test equipment is listed in Chapter 2. The tests should be performed in the order given. A satisfactory result must be obtained from the test being made before continuing with the next.
2. The performance requirements which are stated for each test refer to a newly-manufactured factory-aligned receiver, and should not be applied too rigidly to a receiver which has been in use for a considerable time. Furthermore, the user should assess the accuracy of his own test equipment when evaluating test results. Do not attempt to improve the receiver performance by adjusting any preset trimmer or core etc. other than in an approved test procedure.

NOTE: Signal generator levels are given as e. m. f. unless stated otherwise  
R. F. output voltages are r. m. s. unless otherwise stated.

CAUTION: While making test connections to the 12-way outlet on the rear panel, the receiver should be switched off to avoid an accidental short-circuit on the 1 watt output which might damage transistors.

#### MECHANICAL INSPECTION

3.
  - (1) Check that all modules are inserted and made secure, with covers in position.
  - (2) Check all plug and socket connections.
  - (3) Check correct setting of the following switches at the rear of the receiver.
    - (a) A. C. / D. C. selector switch as appropriate
    - (b) Mains Voltage Selector (225 or 115 as appropriate).
  - (4) The 2nd V. F. O. switch on the front panel should be set to INT.
  - (5) Check that fuses are of correct value and secure in their holders.
  - (6) Set the LOCK controls to OFF.
  - (7) Check all controls for smooth operation.
  - (8) Connect power supply to receiver.

## POWER CHECK

4. (1) Connect the d. c. voltmeter -ve lead, (25 volt range) to the terminal H. T. R. F. on terminal block TB1 (Fig. 19).
- (2) Remove the receiver cover.
- (3) Set the System switch to MAN.
- (4) Check that the voltmeter indicates -16 volts relative to chassis. If necessary, adjust potentiometer RV1 on the power module. (Fig. 18).
- (5) Adjust the DIMMER potentiometer for a suitable level of dial illumination.
- (6) Remove the test equipment.

## SYSTEM CHECK

5. (1) Connect high impedance headphones to PHONES socket.
- (2) Connect the signal generator (impedance 75 ohms) to the R. F. INPUT (Antenna) socket.
- (3) Set the signal generator to 3.5 MHz at 15 microvolts e. m. f. 30% modulation at 400 Hz.
- (4) Set the receiver controls as follows:
  - (a) MHz control to 03.
  - (b) KHz control to 500.
  - (c) R. F. RANGE to WB.
  - (d) AE ATT to MIN.
  - (e) I. F. BW KHz to 3.
  - (f) R. F. GAIN fully clockwise (maximum gain).
  - (g) A. F. GAIN mid-position.
  - (h) CAL-FINE TUNE control to mid-position.
  - (j) DET-B. F. O. switch to A. M.
- (5) Set the System switch to CAL.
- (6) Adjust KHz tuning control around the 500 kHz indication until a beat note is heard in the phones. If necessary, calibrate the tuning scale by setting KHz control to indicate exactly 500 and adjust the CAL-FINE TUNE control to give a zero beat note.



- (7) Set the System switch to CHECK B. F. O. Alter the KHz tuning by approximately 10 kHz. Switch the B. F. O. TUNE control through positions +6 to -6. Note that correct change of beat note occurs at each change of setting.
- (8) Set System switch to MAN.
- (9) Reset KHz control to indicate 500.
- (10) If necessary, adjust signal generator frequency to the frequency of the receiver tuning.
- (11) Set the RA. 1217 meter switch to A. F. position.
- (12) Adjust the preset A. F. LEVEL control (on front panel) and note that the meter indication changes with variation in setting.
- (13) Connect the -ve lead of a d. c. voltmeter, set to the 10 volt range, to the terminal A. G. C. R. F. on the rear panel.
- (14) Set the RA. 1217 meter switch to R. F.
- (15) Switch off the signal generator.
- (16) Set the System switch to the A. G. C. positions Lg. Med and Sh. in turn. Check that -ve 4 volts is indicated on the d. c. voltmeter in each position.
- (17) Switch on the signal generator and adjust the e. m. f. to 1  $\mu$ V.
- (18) Set the R. F. RANGE to 2-4 and adjust R. F. TUNE for maximum signal.
- (19) Set the System switch to A. G. C. Med, then adjust the 'Meter Set Zero' preset control (see Fig. 18), so that 1  $\mu$ V is indicated on the RA. 1217 meter.
- (20) Note that the d. c. voltmeter indicates approximately -ve 4 volts (not less than 3.8v) at the terminal 'A. G. C. R. F. '
- (21) Increase signal generator output in 10 dB steps up to +40 dB, check that the a. g. c. level as shown by the d. c. voltmeter becomes less negative at each 10dB step. Also check that the RA. 1217 meter indicates approximately the appropriate 'S' level at each 10 dB step. At the 12-way rear panel outlet (SKT11) briefly earth pin G (Antenna Muting) and note that the 'S' Meter indication changes from 40 dB down to less than 10 dB when the earth is applied.
- (22) Reduce the signal generator output level until the indication on the receiver front panel meter is 1  $\mu$ V.

- (23) Set the MHz tuning control to '00'. Note that the d.c. voltmeter a g.c. reading is removed.
- (24) Transfer the d.c. voltmeter -ve lead to the terminal H.T. R.F. Turn the MHz control clockwise. Note a reading of -16 volts. Reset the MHz control to '00' and check that the voltmeter reading is removed.
- (25) Set the MHz control to 03 and the System switch to OFF.
- (26) Transfer the -ve lead of the d.c. voltmeter to pin H (A.G.C. DIV) of the 12 way outlet SKT11.
- (27) Check that the signal generator is set to 3.5 MHz: 1 $\mu$ V e.m.f; 30% modulation; 400 Hz.
- (28) Set the System switch to A.G.C. Med. The d.c. voltmeter should indicate 9.5V plus or minus 1 volt.
- (29) Connect an l.f. electronic voltmeter to the terminal DET on TB1; a reading of 200 mV should be obtained.
- (30) Set the System switch to OFF.
- (31) Transfer the electronic voltmeter to the coaxial socket '1.6 MHz OUT'.
- (32) Transfer the signal generator output to the coaxial socket 'L. F. '
- (33) Set the signal generator to 2.5 MHz and an e.m.f. of 200  $\mu$ V.
- (34) Set the System switch to A.G.C. Med and check that the electronic voltmeter indicates not less than 60 mV.
- (35) Set the System switch to OFF.
- (36) Connect an electronic voltmeter to the socket 2nd V.F.O. OUT at the rear of the receiver. (unterminated)
- (37) Set the System switch to MAN.
- (38) Set the 2nd V.F.O. switch to INT. The electronic voltmeter should indicate 100 mV, approximately.
- (39) Set the 2nd V.F.O. switch to EXT. Check that the indication noted in (38) has been removed.
- (40) Reset the 2nd V.F.O. switch to INT. Remove all test equipment.

### Crystal Frequency Check

NOTE 1: Receivers supplying a 100 kHz i. f. output are fitted with a 1.7 MHz crystal; if the i. f. output is 455 kHz the corresponding crystal frequency is 1.145 MHz.

NOTE 2: It will be necessary to remove the covers from the 37.5 MHz Generator Module and the I. F. module to make the adjustments.

6.
  - (1) Connect a digital counter to the rear panel socket 1.7 MHz (or 1.145 MHz)
  - (2) Set the System switch to MAN.
  - (3) Check that the digital counter indicates 1.7 MHz (or 1.145 MHz)  $\pm 2$  Hz.
  - (4) If necessary adjust the trimmer capacitor C4 in the Converter board of the I. F. Unit to achieve the 1.7 MHz indication. (See Fig. L12).
  - (5) Transfer the digital counter to the rear panel socket 1 MHz OUT.
  - (6) Adjust the trimmer C7 located on the 1 MHz board in the 37.5 MHz Generator Module (See Fig. L6, C7 is beside the crystal base).
  - (7) The digital counter should indicate 1 MHz  $\pm 2$  Hz.

### Auxiliary Inputs and Outputs.

NOTE: The receiver will have either a 1.7 MHz crystal (100 kHz i. f.) or a 1.145 MHz crystal (455 kHz i. f.).

7.
  - (1) Terminate with 75 ohms each of the following sockets in turn and connect an electronic voltmeter to the terminated outlet. Set the System switch to MAN. The outputs should be as follows:

TABLE 1

<u>Socket</u>		<u>Required Output</u>
(a)	1. MHz OUT	50 mV in 75 ohms
(b)	1.7 MHz OUT	30 mV in 75 ohms
	or	
	1.145 MHz OUT	30 mV in 75 ohms
(c)	2nd V. F. O. OUT	50 mV in 75 ohms.

- (2) Set the System switch to OFF.
- (3) Disconnect the power from the receiver.
- (4) Remove the 1 MHz crystal from the 37.5 MHz Generator Module.
- (5) Set the 2nd V. F. O. INT/EXT switch to EXT.
- (6) Re-connect the power to the receiver. Set the System switch to MAN.
- (7) Connect a signal generator sequentially to the sockets listed in Table 2 below. The signal generator output to be as stated in each case. Connect an electronic voltmeter and measure the output at the sockets listed in the right hand column of Table 2. The output in each is to be not less than 50 mV into 75 ohms.

TABLE 2

<u>Connect Sig. Gen to these Sockets</u>	<u>Sig. Gen. Frequency</u>	<u>Sig. Gen. Output (75<math>\Omega</math> Source)</u>	<u>Measure Output at the Sockets</u>
1 MHz IN	1 MHz	100 mV e. m. f.	1 MHz OUT
2nd V. F. O. IN	4 MHz	100 mV e. m. f.	2nd V. F. O. OUT

- (10) Set the System switch to OFF. Replace the 1 MHz crystal  
Replace the module covers.

KHz Tuning (2nd V. F. O.) Calibration Check

8. (1) Set the kHz tuning to '000' and the System switch to CAL.
- (2) Adjust the CAL FINE TUNE control for an audio null in the phones.
- (3) Set the kHz tuning initially to 100 and carefully tune with KHz control to obtain an audio null, which should occur within plus or minus 500 Hz of the 100 kHz calibration point.
- (4) Set the kHz scale to exactly 100.
- (5) Adjust the CAL-FINE TUNE control for an audio null.
- (6) Measure the error at 000 kHz by tuning to the audio null in the vicinity of 000 kHz. The null should be within 500 Hz of the 000 kHz scale setting.
- (7) Set the KHz tuning to exactly 200 kHz and adjust the CAL-FINE TUNE control for an audio null.
- (8) Tune to the null and measure the error at the adjacent 100 kHz and 300 kHz points which should be within 500 Hz of the scale settings.

- (9) Repeat this procedure at each 100 kHz point on the kHz scale.
- (10) Calibrate the kHz tuning at the '500' setting. Then check the kHz re-setting accuracy by de-tuning and re-setting to this check point, first from a lower frequency than from a higher. The re-setting accuracy should be within plus or minus 200 Hz.
- (11) Set the kHz scale to 500. Set the CAL-FINE TUNE control full clockwise and tune the kHz control for an audio null. Note the scale reading.
- (12) Set the CAL-FINE TUNE control fully anti-clockwise and tune the kHz control for an audio null. Note the scale reading.
- (13) The difference between the two scale readings of (11) and (12) should be not less than 7 kHz. This is the range of the CAL-FINE TUNE control.

#### MHz Tuning (1st V. F. O.) Calibration Check

9. (1) Connect a digital counter to either of the free coaxial plugs of the 1st V. F. O. module. These are located on a bracket on the underside of the receiver. (Fig. 18).
- (2) Set the System switch to MAN.
- (3) Set the MHz tuning scale to indicate 01.
- (4) The digital counter should display a frequency of 41.5 MHz plus or minus 20 kHz. If necessary make a careful adjustment of the MHz control setting to obtain this reading.
- (5) Adjust the MHz tuning control over its full range of free movement but without changing the scale indication. The digital counter should indicate a variation of plus or minus 0.12 MHz approximately.
- (6) Set the MHz tuning control to 29 and adjust carefully.
- (7) The digital counter should display 69.5 MHz plus or minus 20 kHz.
- (8) Set the MHz tuning successively in steps of 1 MHz from 01 to 20 on the scale. The digital counter should display 41.5 MHz at 01 increasing by 1 MHz at each step. All

frequencies should be plus or minus 20 kHz. At each MHz point, free movement of the MHz control should produce a frequency variation of approximately plus or minus 0.12 MHz on the digital counter display.

- (9) Remove all test equipment. Re-connect the 1st V. F. O. coaxial plug to its chassis socket.

#### B. F. O. Calibration

10. (1) Remove the cover from the I. F. Module.
- (2) Connect a digital counter to test point TP1 on the detector board in the i. f. module. (On the collector of VT1, Fig. 12).
- (3) Set the System switch to CHECK B. F. O. and adjust the B. F. O. TUNE control for an audio null.
- (4) Operate the DET-B. F. O. control through all positions. Check that the digital counter indicates the frequency in accordance with Table 3.

TABLE 3

#### B. F. O. CHECK

<u>Det - B. F. O. Control Setting</u>	<u>Measured Frequency at TP1 on Detector Board.</u>
L. S. B.	1 601 500 Hz $\pm 2$ Hz
U. S. B.	1 598 500 Hz $\pm 2$ Hz
+6	1 606 000 Hz nominal
+3	1 603 000 Hz nominal
-3	1 597 000 Hz nominal
-6	1 594 000 Hz nominal

- (5) In the '0' position of the DET-B. F. O. switch check that the B. F. O. TUNE control gives a frequency shift of not less than plus or minus 3 kHz.
- (6) Remove the test equipment. Replace the cover on the module.

**CAUTION:** This chapter refers to audio power meter measurements on both the 10 mW 600 $\Omega$  and the 1-watt 15 $\Omega$  versions of the RA.1217. The user must ensure that the correct termination is used for the particular version of the receiver under test. If in doubt, refer to the Preface at the beginning of Chapter 1 for advice on audio amplifier identification.

#### Overall Receiver Sensitivity Check

**NOTE:** The audio power meter must be terminated in 15 ohms for a 1-watt receiver or in 600 ohms for a 10 mW receiver.

11.
  - (1) Terminate the power meter in 600 ohms (10 mW output) or 15 ohms (1-watt output) and connect it to the audio output at pin D and pin C (screen) of the 12-way outlet 1SKT11.
  - (2) Connect the H.F. electronic voltmeter to the unterminated 1.6 MHz OUT socket. The length of cable between socket and voltmeter must not exceed 12 inches. (30 cms).
  - (3) Connect the Signal generator to the R.F. INPUT (Antenna) socket. Set the generator to 3.5 MHz modulated 30% at 400 Hz. Output level 1  $\mu$ V e.m.f. from 75 $\Omega$  source.
  - (4) Set the receiver controls as follows:-
    - (a) AE ATT to MIN.
    - (b) R.F. RANGE to 2-4 MHz.
    - (c) R.F. TUNE tuned to 3.5 MHz.
    - (d) DET - B.F.O. switch to A.M.
    - (e) R.F. GAIN fully clockwise (maximum gain).
    - (f) I.F. B.W. switch to 3.
    - (g) System switch to MAN.
  - (5) Tune receiver MHz and KHz controls to 3.5 MHz and make fine adjustments to obtain maximum output on the electronic voltmeter. Peak the R.F. TUNE control.
  - (6) Set the System switch to A.G.C. Med.
  - (7) Observe the maximum level indicated on the electronic voltmeter which should be not less than 60 mV.
  - (8) Adjust the A.F. GAIN control for maximum output on the power meter. Note the indicated level which should be not less than 10 mW into 600 $\Omega$  or 1 watt into 15 $\Omega$ .
  - (9) Transfer the electronic voltmeter to the 100 kHz OUT socket on the rear panel, the output to be terminated in 75 ohms. Note the output level as follows:-
    - (a) For 100 kHz output not less than 230 mV.

- (10) Set the System switch to MAN.

Single-Signal Selectivity

12. (1) Set the RA.1217 controls as follows:-
- (a) AE ATT to MIN.
  - (b) R.F. RANGE to 2-4 MHz.
  - (c) R.F. TUNE tuned to 3.5 MHz.
  - (d) I.F. B. W. switch to .2 (200 Hz).
  - (e) R.F. GAIN fully clockwise (maximum gain).
  - (f) DET-B.F.O. to A.M.
  - (g) System switch to MAN.
- (2) Set the signal generator to 3.5 MHz, c.w. 1  $\mu$ V e.m.f.
- (3) Connect the digital frequency meter directly to the signal generator output and accurately tune the generator to 3.5 MHz. Remove the digital frequency meter and connect the signal generator to the receiver R.F. INPUT (Antenna) socket.
- (4) Connect the H.F. electronic voltmeter to the 1.6 MHz OUT socket of the receiver.
- (5) Connect the digital frequency meter in parallel with the electronic voltmeter using a sensitive probe.
- (6) Tune the receiver to obtain the maximum indication of the electronic voltmeter. Note the output level obtained, as a reference.
- (7) Decrease the frequency of the signal generator until the indication of the electronic voltmeter is 3 dB down relative to the reference level noted in (6). Note the frequency on the digital frequency meter.
- (8) Increase the frequency of the signal generator above 3.5 MHz until the electronic voltmeter again indicates 3 dB down relative to the reference level noted in (6). Note the frequency on the digital frequency meter.
- (9) Calculate the bandwidth by subtracting the frequency noted in (7) from that noted in (8). This shall be 200 Hz plus or minus 50 Hz.



- (10) Repeat the procedure outlined in operations (2) to (9) for each setting of the I.F. BW. switch, setting the signal generator frequency accordingly. The limits shall be as specified below.

<u>I.F. BW Setting</u>	<u>Minus 3 dB Bandwidth</u>
3 kHz	3 kHz $\pm$ 300 Hz
8 kHz	8 kHz $\pm$ 800 Hz
1.2 kHz )	1.2 kHz $\pm$ 120 Hz
6.0 kHz ) if fitted	6.0 kHz $\pm$ 600 Hz
13 kHz )	13 kHz $\pm$ 1300 Hz

- (11) Disconnect the electronic voltmeter and digital frequency meter.

✓ Signal-to-Noise Ratio (C. W. and S.S.B.)

13. (1) Connect the power meter (terminated in 600 $\Omega$  for 10 mW or 15 $\Omega$  for 1-watt) to the audio output (1SKT11 pins D and C).
- (2) Connect the signal generator to the R.F. INPUT (Antenna) socket. Set the output to 1  $\mu$ V e.m.f. and the frequency to 3.5 MHz.
- (3) Set the receiver controls as follows:-
- (a) R.F. RANGE to 2-4 MHz.
  - (b) AE ATT to MIN.
  - (c) I.F. BW to 3 kHz.
  - (d) DET-B.F.O. to USB.
  - (e) R.F. GAIN fully clockwise (max. gain).
  - (f) A.F. GAIN fully clockwise (max. gain).
  - (g) Set the System switch to MAN.
- (4) Tune the receiver (including the R.F. TUNE) to obtain maximum a.f. output on the power meter.
- (5) Set the System switch to A.G.C. "Med" and adjust the A.F. GAIN control until the power meter indicates a reference level of 10 mW into 600 $\Omega$  or 1 watt into 15 $\Omega$  according to the type of audio board fitted.
- (6) Set the System switch to MAN and adjust the R.F. GAIN control to restore the power meter reading to the reference level noted in (5).
- (7) Set the signal generator to CARRIER OFF.
- (8) Note the power meter reading which should be not less than 15 dB below the reference level noted in (5).

- (9) Set the R.F. RANGE switch to WB.
- (10) Set the signal generator to CARRIER ON and increase the generator output to 15  $\mu$ V.
- (11) Repeat the procedures (6) to (9) inclusive.

#### Signal-to-Noise Ratio (M. C. W.)

14. On completion of the C. W. Signal-to-Noise check continue as follows:-
  - (1) Set the DET-B.F.O. switch to A.M.
  - (2) Set the System switch to MAN.
  - (3) Set the signal generator output to 30% modulation at 400 Hz at an e.m.f. of 3  $\mu$ V.
  - (4) Set the R.F. RANGE to 2-4 and tune for a maximum output on the power meter.
  - (5) Set the System switch to A.G.C. "Med" and adjust the A.F. GAIN control until the power meter indicates a reference level of 10 mW into 600 $\Omega$  or 1 watt into 15 $\Omega$  according to the type of audio board fitted.
  - (6) Switch off the modulation at the signal generator. Note the power meter reading which should be at least 15 dB below the reference level noted in (5).
  - (7) Disconnect the power meter.

#### Gain/Frequency Characteristic

15. (1) Connect a signal generator to the R.F. INPUT (Antenna) socket. Set the signal generator to 1 MHz at 1  $\mu$ V e.m.f. C. W. Maintain the generator e.m.f. at 1  $\mu$ V throughout the tests.
- (2) Connect the H.F. electronic voltmeter to the 1.6 MHz OUT socket using short leads.
- (3) Set the receiver controls as follows:-
  - (a) AE ATT to MIN.
  - (b) R.F. RANGE to 1-2 MHz.
  - (c) R.F. GAIN fully clockwise (maximum gain).
  - (d) I.F. BW to 3.
  - (e) DET-B.F.O. to L.S.B.
  - (f) System switch to MAN.
  - (g) Meter switch to R.F.

- (4) Tune the receiver (including R.F. TUNE) for a maximum output on the electronic voltmeter of not less than 60 mV. Note the actual reading obtained.
- (5) Set the signal generator successively to the following frequencies (at 1  $\mu$ V) and repeat operation (4). Record the readings obtained:-  
1.5 MHz 2.0 MHz 3.0 MHz 4.0 MHz 6.0 MHz 12.0 MHz 16.0 MHz 24.0 MHz and 29.999 MHz.  
Each output should be within a 12 dB range over the frequency band 1-30 MHz. The minimum level shall be not less than 35 mV and the maximum level not greater than 250 mV.

#### A. G. C. Characteristic Check

16. (1) Connect the signal generator to the R.F. INPUT (Antenna) socket.
- (2) Set the signal generator to 10.5 MHz, modulation 30% at 400 Hz, e.m.f. 2  $\mu$ V.
- (3) Connect the power meter (terminated in 600 $\Omega$  for 10 mW or 15 $\Omega$  for 1 watt) to the audio output (1SKT11 pins D and C).
- (4) Set the receiver controls as follows:-
  - (a) R.F. RANGE to 8-16 MHz.
  - (b) AE ATT to MIN.
  - (c) I.F. BW to 3.
  - (d) DET-B.F.O. to A.M.
  - (e) R.F. GAIN fully clockwise (maximum gain).
  - (f) System switch to MAN.
- (5) Tune the receiver (including R.F. TUNE) to 10.5 MHz and adjust for maximum output on the power meter.
- (6) Set the System switch to AGC Med.
- (7) Adjust the A.F. GAIN control to provide a reference reading on the power meter of either 1 mW into 600 $\Omega$  or 10 mW into 15 $\Omega$ .
- (8) Increase the signal generator output to plus 85 dB relative to 2  $\mu$ V. Check that the power meter indication does not increase by more than +4 dB.
- (9) Reset the signal generator to 2  $\mu$ V and then repeat operation (8) in the AGC 'sh' and AGC 'lg' settings of the System switch.
- (10) The power meter should remain connected for the Noise Factor check.

### Noise Factor Check

17. (1) Connect the noise generator (75 $\Omega$  source) to the R.F. INPUT (Antenna) socket. Do not switch on the noise generator.
- (2) Connect the power meter (terminated in 600 $\Omega$  for 10 mW or 15 $\Omega$  for 1 watt) to the audio output (1SKT11 pins D and C).
- (3) Set the receiver controls as follows:-
- (a) AE ATT to MIN.
  - (b) System switch to MAN.
  - (c) DET-B.F.O. to U.S.B.
  - (d) I.F. BW to 3.
  - (e) R.F. GAIN fully clockwise (maximum).
  - (f) The R.F. RANGE and R.F. TUNE should be set to the appropriate settings for peak tuning at each test.
- (4) Check that the noise generator is switched off. Set R.F. RANGE to 1-2 and tune the receiver (including R.F. TUNE) to 01.000 MHz. Carefully adjust the MHz control for maximum indication on the power meter and peak the R.F. TUNE control.
- (5) Adjust the A.F. GAIN control for 100 mW on the power meter.
- (6) Switch on the noise generator and increase its output until the power meter reading is increased by +3 dB. The increase in noise generator output (noise factor) to achieve this increase should not exceed 10 dB.
- (7) Repeat operations (4), (5) and (6) at the following frequencies:  
1.5 MHz 2.0 MHz 3.0 MHz 4.0 MHz 6.0 MHz 12.0 MHz,  
tuning the receiver to the appropriate range in each case.
- (8) With the R.F. RANGE switch set to '16-32' repeat the procedures of (4), (5) and (6) checking that the noise factor does not exceed 12 dB at 16.0, 24.0 and 29.999 MHz.
- (9) Disconnect the Noise Generator.

### First Mixer Balance Check

18. CAUTION: Do not remove the cover from the 1st mixer and 40 MHz filter module. A suitable alignment hole is in the cover.
- (1) Connect the signal generator to the R.F. INPUT (Antenna).
- (2) Set the signal generator to 3.5 MHz, C.W., e.m.f. 15  $\mu$ V.

- (3) Connect the power meter (terminated in  $600\Omega$  for 10 mW or  $15\Omega$  for 1 watt) to the audio output (1SKT11 pins D and C).
- (4) Connect the electronic voltmeter to the socket 1.6 MHz OUT.
- (5) Set the receiver controls as follows:-
  - (a) AE ATT to MIN.
  - (b) R.F. RANGE to WB.
  - (c) DET-B.F.O. to U.S.B.
  - (d) I.F. BW to 3.
  - (e) R.F. GAIN fully clockwise (maximum gain).
  - (f) MHz tuning to 3 and KHz tuning to 500.
  - (g) Meter switch to A.F.
  - (h) System switch to MAN.
- (6) Tune the receiver to a maximum reading on the power meter and set the A.F. GAIN control to obtain 100 mW on the power meter as a reference level.
- (7) Set the signal generator frequency to 20 MHz.
- (8) Increase the signal generator output by plus 60 dB relative to 15  $\mu$ V.
- (9) Vary the signal generator tuning around the 20 MHz point until a maximum reading is obtained on the power meter.
- (10) Balance the mixer by adjusting the potentiometer RV1 on the 1st Mixer board (Fig. L8) to obtain a minimum output on the power meter. Check that this minimum reading is not less than 60 dB down relative to the reference level noted in (6).
- (11) Remove the signal generator.

#### Spurious Response to Internal Signals

CAUTION: Spurious responses can occur if module securing screws are slack or if covers are loose.

19.
  - (1) Ensure that all module covers are secure also the top and bottom covers of the receiver.
  - (2) Connect the power meter (terminated in  $600\Omega$  for 10 mW or  $15\Omega$  for 1 watt) to the audio output (1SKT11 pins D and C).
  - (3) Disconnect and switch off the signal generator and terminate the R.F. INPUT (Antenna) socket with 75 ohms.

- (4) Set the Receiver controls as follows:-
- (a) AE ATT to MIN.
  - (b) R.F. RANGE to WB.
  - (c) DET-B.F.O. to U.S.B.
  - (d) R.F. GAIN fully clockwise (Maximum).
  - (e) I.F. BW to 3 kHz.
  - (f) System switch to MAN.
  - (g) Set the MHz and KHz tuning to 01.000 initially.
- (5) Adjust the MHz tuning carefully for maximum noise level on the power meter.
- (6) Adjust the A.F. GAIN control to obtain a noise level on the power meter of 1 mW into 600 $\Omega$  or 100 mW into 15 $\Omega$ .
- (7) Turn the KHz tuning control slowly and carefully through its range from 000 to 999. When a spurious response is heard in the phones, offset the KHz tuning until the response is no longer audible and then adjust the A.F. GAIN control to restore the reference level noted in (6).
- (8) Retune the KHz tuning to the spurious response and carefully tune to obtain a peak reading on the power meter.
- (9) Note the increase in the power meter reading relative to the reference level obtained in (7). This increase should not exceed 3 dB.
- (10) Repeat operations (5) to (9) at each setting of the MHz control from 02 up to 29.
- (11) Repeat operations (5) to (9), with the R.F. RANGE set to the appropriate range, and the R.F. TUNE control adjusted to maximum noise setting at each MHz setting from 02 up to 29.
- (12) On completion remove the 75 $\Omega$  termination from the R.F. INPUT socket.

#### Spurious Response to External Signals

- 20.
- (1) Connect the signal generator to the R.F. INPUT (Antenna) socket.
  - (2) Set the signal generator to 3.5 MHz, C.W. 1  $\mu$ V e.m.f.
  - (3) Connect the power meter (terminated in 600 $\Omega$  for 10 mW or 15 $\Omega$  for 1 watt) to the audio output (1SKT11 pins D and C).

- (4) Set the receiver controls as follows:-
- (a) AE ATT to MIN.
  - (b) R.F. RANGE to 2-4 MHz.
  - (c) DET-B.F.O. to L.S.B.
  - (d) R.F. GAIN fully clockwise.
  - (e) I.F. BW to 3 kHz.
  - (f) System Switch to MAN.
- (5) Tune the receiver (including R.F. TUNE) to the signal generator frequency for a maximum power output.
- (6) Adjust the A.F. GAIN control to obtain a reference reading on the power meter of either 1 mW for the 10 mW receiver or 100 mW for the 1 watt receiver.
- (7) Set the signal generator to 3.55 kHz and increase the signal generator output level to +70 dB. Make a very fine adjustment of the MHz control until a spurious frequency is heard. Lock the tuning controls at this point. (If locks are fitted).
- (8) Tune the signal generator carefully from 3 MHz up to 4 MHz. If a spurious frequency is found, adjust the signal generator output to restore the appropriate reference level noted in (6). Check that such generator level settings are not less than 60 dB above 1  $\mu$ V to provide the appropriate reference level.
- (9) If a spurious response is located, which results in a signal generator level of less than 60 dB for the reference level reading on the power meter, proceed as follows:-
- (i) Remove the cover from the 37.5 MHz Generator module.
  - (ii) Make a small adjustment of the potentiometer RV1 on the Harmonic Mixer board (Fig. L-7) to reduce the spurious response, as shown by a fall in the power meter reading.

NOTE: For access to the Harmonic Mixer board remove the cover from the 37.5 MHz Generator module.

- (iii) Adjust the signal generator output level to obtain the reference level on the power meter (either 1 mW or 100 mW as appropriate). The signal generator level should be not less than 60 dB, in accordance with operation (8). If necessary make a further small adjustment of RV1 and repeat the test.

- (iv) Replace the cover on the 37.5 MHz Generator module and the receiver cover.
- (v) Repeat operation (8).
- (10) Disconnect the signal generator and power meter.



CHAPTER 4  
=====  
ALIGNMENT PROCEDURES

INTRODUCTION

1. The purpose of this chapter is to enable the modules of a receiver to be tested to a serviceable standard. The tests are designed to be as independent as is practicable, so that the checks on a particular module rely as little as possible on the correct functioning of another module, thereby providing a useful aid to the fault location chapter. If the user wishes to check the overall performance of the receiver, reference should be made to Chapter 3.

NOTE: Throughout this chapter the signal generator output level in each test is given as e.m.f. unless otherwise stated. All r.f. voltages are r.m.s. unless otherwise stated.

CAUTION: Under normal conditions the receiver will maintain the factory alignment over a long period of time, consequently any other causes of trouble should be eliminated before re-alignment is undertaken. If it becomes necessary to re-align any part of the receiver, only small angular adjustments of any trimmers or tuning slugs should be necessary. When replacing access covers, module shields, etc., ensure that all screws are firmly secured to prevent any spurious signals from affecting the receiver, but do not over-tighten, to the extent that screw-hole threads become damaged.

PROCEDURES

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## AUDIO AMPLIFIER BOARD

### (1 watt Version)

#### Test Equipment

3. Multimeter: 20 000 ohms/volt. (AVO 8).  
Soldering Iron.

#### Initial Control Settings

4. R.F. GAIN and A.F. GAIN fully anti-clockwise (minimum).

#### Setting Procedure

5. (1) Remove the metal panel from the underside of the receiver.  
(2) Set the multimeter to the 25 volt d.c. range:  
Connect the -ve lead to pin 5 on the audio amplifier board  
and the +ve lead to chassis.  
(3) Set the System switch to MAN.  
(4) Adjust the potentiometer RV1 on the audio board for a  
reading of -8 volts on the multimeter.  
(5) Set the System switch to OFF and unsolder the h.t. (violet)  
lead from pin 6 of the board.  
(6) Set the multimeter to the 100 mA d.c. range and connect in  
series with pin 6 and the disconnected h.t. lead. (+ve lead  
to pin 6).  
(7) Set the System switch to MAN and adjust potentiometer RV2  
on the board for a reading of 55 mA on the multimeter.  
(8) Set the System switch to OFF.  
(9) Remove the multimeter and re-solder the h.t. lead to pin 6.  
(10) Repeat operations (2), (3) and (4), adjusting RV1 if necessary.  
(11) Remove the test equipment and replace the metal panel.

## AUDIO AMPLIFIER BOARD

### (10 mW Version)

There are no adjustments in the 10 mW audio amplifier board.

Refer to Chapter 3 paragraph 11 for a check procedure. If the 10 mW level cannot be obtained in operation (8) of that paragraph it will be necessary to employ basic servicing methods to find the cause of low output.

## I. F. MODULE

### Test Equipment

6.           Signal Voltmeter.  
             D. C. Voltmeter.  
             Electronic Voltmeter.  
             Digital Frequency Meter.  
             Power Meter: (600 $\Omega$  for 10 mW or 15 $\Omega$  for 1 watt measurements).  
             0.1  $\mu$ F Capacitor 30V rating.

### Initial Control Settings

7.           R. F. GAIN - Fully clockwise.  
             A. F. GAIN - Fully clockwise.  
             System switch - MAN.  
             DET - B. F. O. switch - A. M.  
             BANDWIDTH - 3 kHz.

### Alignment Procedure

Fig. L-12   Fig. 12   Fig. 18

CAUTION 1:       Coaxial Test connections to the 1.6 MHz OUT socket at the rear panel must be short. (Not longer than 12 inches, 30 cm).

CAUTION 2:       Note the alternative terminations for the 10 mW (600 $\Omega$ ) and 1 watt (15 $\Omega$ ) audio outputs. The user must determine which one is appropriate for the particular receiver under test.

NOTE:           To make tests and adjustments within the I. F. Module the module cover and the receiver sideplate must be removed. Refer to Chapter 7 page 7-2 for removal instructions.

8.           (1)       Disconnect the coaxial input lead from the socket SKT4 at the forward end of the i. f. module.
- (2)       Connect the electronic voltmeter to the rear panel socket 1.6 MHz OUT using a short lead.
- (3)       Connect the D. C. voltmeter (10V range) to pin 3 on the I. F. Amplifier board (-ve lead).
- (4)       Adjust potentiometer RV1 on the A. G. C. board to produce a reading of -4 volts on the voltmeter.
- (5)       Set the signal generator to 1.6 MHz  $\pm$ 10 Hz at an e. m. f. of 40 microvolts. Connect the generator to the i. f. input, SKT4 at the forward end of the I. F. Module.
- (6)       Note the 1.6 MHz output level on the electronic voltmeter which should be between 80 and 150 mV. If below 80 mV, align the coils in the following order for maximum output on the electronic voltmeter.
- L1 on the A. G. C. board.  
                     L2 and L1 on the I. F. Amplifier board.

## I.F. Module (Continued)

- (7) Terminate the audio output (SKT11 pins D and C) in  $600\Omega$  (10 mV) or  $15\Omega$  (1 watt) and connect the power meter.
- (8) Set the signal generator to 1.6 MHz modulated 30% at 1000 Hz, and check that the audio output is not less than 10 mW (or 1 watt). (A.F. GAIN fully clockwise).
- (9) If the 10 mW (or the 1 watt) indication is not obtained, adjust the cores L3 on I.F. Amplifier board and T1 on the Detector board to obtain such an indication on the Power meter.
- (10) Switch off the modulation and set the DET - B.F.O. switch to L.S.B. and U.S.B. in turn. Note that the Power meter reads at least 10 mW (or 1 watt) in each setting.
- (11) Set the DET - B.F.O. switch successively to the positions +6 through to -6 and note that the 10 mW (or 1 watt) output is obtained in each setting.
- (12) Set the DET - B.F.O. switch to A.M. and the System switch to A.G.C. 'Sh'.
- (13) Increase the signal generator output level by +36 dB. Observe the change of reading on the electronic voltmeter which should not exceed +3 dB. If the indication is satisfactory, omit the next operation.
- (14) If, in operations (13) the electronic voltmeter reading showed an increase of more than 3 dB adjust L2 in the A.G.C. board to produce a minimum level in the electronic voltmeter reading.
- (15) Re-set the signal generator output according to operation (5).
- (16) Terminate the 100 kHz OUT socket in 75 ohms. Connect the electronic voltmeter across the termination. For a 1.6 MHz 40 microvolt input to the i.f. unit the output should be not less than 230 mV into 75 ohms at 100 kHz. If the output is low adjust L1 on the converter amplifier board. If necessary adjust L2 and L1 on the converter oscillator board.

**CAUTION:** Peaking of the converter board inductors can adversely affect the selectivity characteristics. Set the I.F. BW switch to the widest bandwidth and tune the signal generator through the receiver passband; note that the response is symmetrical.

### I. F. Module (Continued)

- (18) Connect the digital counter to the 1.7 MHz IN/OUT socket (1.145 MHz OUT). Check the appropriate frequency. If necessary adjust C4 on the oscillator board to obtain the required frequency  $\pm 2$  Hz.
- (19) Remove the counter and connect the electronic voltmeter in its place. A reading of not less than 100 mV should be obtained.

### B. F. O. Check

NOTE: Refer to Chapter 3 page 3-8 para. 10 for calibration check. If necessary align as follows:-

9. (1) Connect a digital counter to test point TP1 on the detector board in the I. F. Module via a 0.1  $\mu$ V capacitor.
- (2) Set the System switch to MAN.
- (3) Set the B. F. O. TUNE control to the mid-point of its movement. (Capacitor vanes at half-mesh).
- (4) Set the B. F. O. KHz switch to L. S. B. The counter should read 1601.50 kHz  $\pm 2$  Hz. If necessary adjust the Trimmer capacitor C21 on the Detector board to obtain the correct frequency.
- (5) Set the DET - B. F. O. switch to U. S. B. The counter should read 1598.50 kHz  $\pm 2$  Hz. If necessary adjust Trimmer capacitor C22 on the Detector board to obtain this frequency.
- (6) Set the DET - B. F. O. switch to +6. Refer to Fig. L-13 and Fig. 18 to identify B. F. O. board. Adjust coil L1 in the B. F. O. board for a frequency of 1.606 000 Hz, plus or minus 100 Hz.
- (7) Set the DET - B. F. O. switch and adjust the appropriate capacitor on the 600 kHz B. F. O. board, to an accuracy of  $\pm 100$  Hz as follows:

<u>B. F. O. Switch Setting</u>	<u>Capacitor to Adjust</u>	<u>Frequency (Hz)</u>
+3	C2	1 603 000
0	C3	1 600 000
-3	C5	1 597 000
-6	C6	1 594 000

- (8) Remove all test equipment.
- (9) Leave the coaxial input lead to the i. f. unit (PL3) disconnected for the 3rd Mixer check which follows:-

### 3RD MIXER

#### Test Equipment

10. Two Signal Generators with frequency ranges up to 6 MHz and 4 MHz respectively.  
Electronic Voltmeter.

#### Initial Control Settings

11. System Switch - MAN  
2nd V. F. O. Switch - EXT  
MHz Tuning - set to 00 MHz  
CAL-FINE TUNE Control - Mid-position of its travel

#### Alignment Procedure

Fig. L-11, Fig. 11

12. (1) Connect the signal generator to the 2nd V. F. O. IN socket on the rear panel.
- (2) Connect the electronic voltmeter to test point TP2 on the 3rd Mixer board.
- (3) Set the Signal Generator to 5.6 MHz and set the attenuator on the generator for a convenient reading on the electronic voltmeter (50 mV).
- (4) Tune coil L4 for a minimum on the electronic voltmeter.
- (5) Set the generator to 3 MHz and tune L6 for minimum on the electronic voltmeter.
- (6) Set the generator to 3.6 MHz and tune L7 for maximum on the R. F. voltmeter.
- (7) Set the generator to 4.6 MHz and tune L2 for maximum on the electronic voltmeter.
- (8) Repeat the above procedures until the response is flat within 3 dB from 3.6 to 4.6 MHz.
- (9) Transfer the signal generator to the socket L. F. on the rear panel.
- (10) Connect the electronic voltmeter to pin 1 on the 3rd Mixer board.
- (11) Set the generator to 3 MHz and set the generator output for a 50 mV reading on the electronic voltmeter.
- (12) Tune coil 1L1 on the 3rd Mixer for maximum reading on the electronic voltmeter.
- (13) Tune the generator from 2 MHz to 3 MHz and check that the output remains constant within 2 dB.

### 3rd Mixer (Continued)

- (14) Transfer the signal generator from the L. F. socket to pin 3 on the 2nd MIXER board. Set the generator accurately to  $2.4 \text{ MHz} \pm 10 \text{ Hz}$ . Adjust the generator output level to a p.d. of  $10 \text{ mV}$  measured at pin 3 on the 2nd Mixer board.
- (15) Connect a second signal generator to the 2nd V. F. O. IN socket on the rear panel. Set this generator accurately to  $4 \text{ MHz} \pm 10 \text{ c/s}$  and an e.m.f. of  $100 \text{ mV}$ .
- (16) With the input lead at the forward end of the I. F. Unit (PL3) disconnected, terminate the lead in  $100 \text{ ohms}$ . Connect the electronic voltmeter across the termination.
- (17) On the 3rd Mixer board tune coils L5 and L3 for maximum reading on the electronic voltmeter.
- (18) Check that a stage gain of not less than unity is obtained (calculated from the p.d. at pin 3 on the 2nd Mixer to the p.d. at the  $100 \text{ ohm}$  termination). Normally the gain is approximately  $+3 \text{ dB}$ .
- (19) Remove the test equipment. Reset the 2nd V. F. O. switch to INT.

## 2ND MIXER

### Test Equipment

13. Two Signal Generators each with a frequency range up to 40 MHz.  
Electronic Voltmeter.

### Initial Control Settings

14. System switch - MAN  
MHz tuning - Set to indicate 00 MHz to disable 1st V.F.O. etc.

### Alignment Procedure

Fig. L-9 Fig. 9

15. (1) Remove the 1 MHz crystal from the 1 MHz module. (Fig. L-6)  
Connect the R.F. voltmeter to TP2 on the 2nd Mixer board. Connect the signal generator to pin 1.
- (2) Set the signal generator to 37.5 MHz and an e.m.f. of 10 mV.
- (3) Tune coil T1 for maximum on voltmeter. The output should be approximately 100 mV.
- (4) Connect the electronic voltmeter to pin 3.
- (5) Connect the signal generator to the socket L.F. on the rear panel.
- (6) Set the signal generator to 3.66 MHz and tune coil L2 for a minimum.
- (7) Set the signal generator to 2.6 MHz and tune L3 for a minimum. The signal generator attenuator may have to be increased as the minimum is approached to obtain a reading on the voltmeter.
- (8) Set the signal generator to 1.3 MHz and tune L6 for a minimum.
- (9) Set the signal generator to 4.5 MHz and tune L5 for a minimum.
- (10) Set the signal generator to 2.5 MHz and tune coils L1 and T2 for maximum.
- (11) Set the signal generator to 2.1 MHz and tune L4 for a maximum.
- (12) Repeat operations (6) to (11) until a response is obtained which is flat within 3 dB from 2 to 3 MHz.
- (13) Disconnect the signal generator.



NOTE: Two signal generators are required for the following Mixer test.

- (14) Set signal generator No. 1 to 37.5 MHz at an e.m.f. of 10 mV and connect it to pin 1 of the 2nd Mixer board.
- (15) Set signal generator No. 2 to 40 MHz and connect it to pin 6 of the 2nd Mixer board. Adjust this generator for a p.d. of 10 mV measured at pin 6.
- (16) Connect the electronic voltmeter to pin 3 (output) of the mixer board and check that a reading of 10 mV  $\pm 3$  dB is obtained.
- (17) Disconnect all test equipment.

## 37.5 MHz GENERATOR MODULE

### 1 MHz AMP, OSCILLATOR AND CALIBRATOR SECTION

#### Test Equipment

16. Signal Generator with a frequency range at least to 37.5 MHz.  
Electronic Voltmeter  
Digital Frequency Meter (Counter)  
Oscilloscope

#### Initial Control Settings

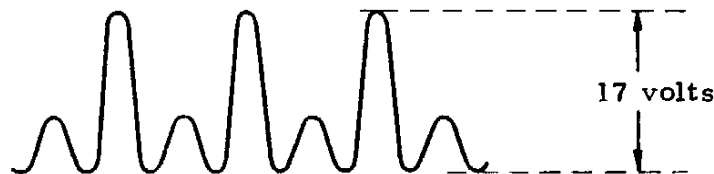
17. System Switch - MAN

#### Alignment Procedure

Fig. L-6 Fig. 6

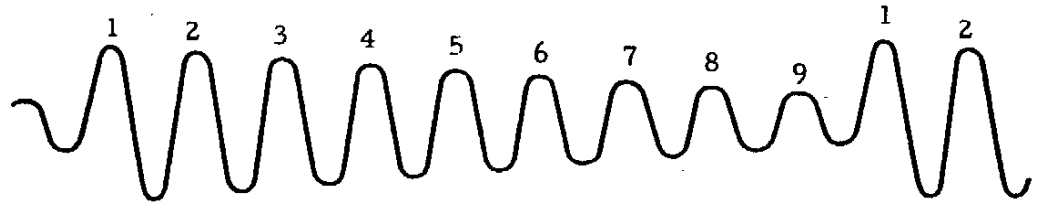
NOTE: The 1 MHz and Calibrator Section is on the upper deck of the module. Refer to the illustration in Fig. L-7.

18. (1) Check that the 1 MHz crystal is secure in its holder on the oscillator board.
- (2) Connect the electronic voltmeter to the rear panel socket '1 MHz OUT' and check for a reading of approximately 100 mV.
- (3) Connect the counter to the '1 MHz OUT' socket. The frequency should be 1 MHz  $\pm$  2 Hz. If necessary adjust capacitor C7 on the oscillator board to achieve the required frequency.
- (4) Connect the oscilloscope to the junction of C12 and R17 on the amplifier board.
- (5) Adjust the coil L1 on the amplifier board for maximum amplitude which should be approximately 17 volts. The approximate waveform is shown below



- (6) Remove the 1 MHz Crystal from its holder on the oscillator board.
- (7) Connect the signal generator to the '1 MHz IN' socket. Set the signal generator to 1 MHz and 100 mV e. m. f.

- (8) Transfer the electronic voltmeter to the junction of C4 and C5 on the oscillator board and check for a reading of approximately 100 mV.
- (9) Replace the crystal. Disconnect the signal generator and electronic voltmeter.
- (10) Connect the oscillator to the collector of VT2 on the oscillator board. Adjust coils L1, L2 and L3 for the correct display as shown below.

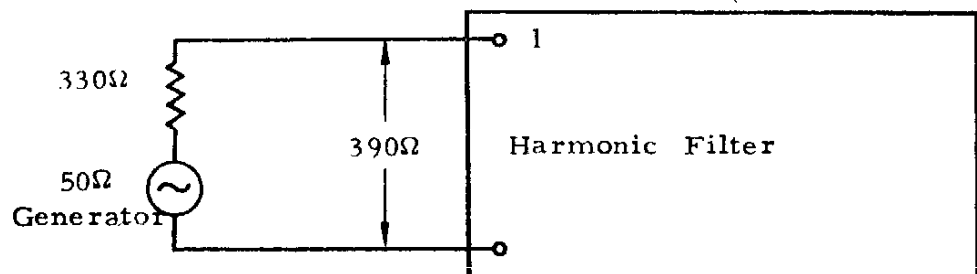


- (11) Transfer the oscilloscope to the -ve side of D6, (pin A2 in the corner of the board). The display should be 300 mV peak-to-peak.
- (12) Remove the test equipment and proceed with a check of the lower deck of the module. Switch off the receiver.

#### HARMONIC GENERATOR, MIXER AND 37.5 MHz AMPLIFIER

19. Refer to Fig. L-7 and to Chapter 7 for access instructions.

- (1) Disconnect the Harmonic Filter from the Harmonic Generator by unsoldering the lead from pin 1 on the Harmonic Filter.
- (2) Connect the electronic voltmeter to pin 2 on the Harmonic Mixer board.
- (3) Connect a signal generator, source impedance 390 ohms to pin 1 of the Harmonic Filter. See diagram below.



- (4) Set the signal generator output to 2 volts e. m. f. Explore the passband of the Harmonic Filter from 1 MHz to 32 MHz. The ripple should not exceed 3 dB. If necessary adjust capacitors C2, C4, C6 and C8 in the Harmonic Filter for minimum ripple.
- (5) Set the signal generator to 33 MHz and check that the output is 8 dB down relative to the level at 32 MHz.
- (6) Disconnect the signal generator and electronic voltmeter. Reconnect the lead unsoldered in (1). Switch on the receiver.
- (7) Connect the oscilloscope to pin 1 of the Harmonic Generator board. The waveform and amplitude should be as measured in para. 18 operation (5) (approx. 17V p-p).
- (8) Transfer the oscilloscope to pin 2 of the Harmonic Mixer board. The amplitude should be approx. 1.2V peak-to-peak.
- (9) Transfer the electronic voltmeter to pin 5 on the Harmonic Mixer board.
- (10) Connect the signal generator to pin 4 on the Harmonic Mixer board.
- (11) Set the signal generator to 37.5 MHz at 2 mV e. m. f.
- (12) Tune coil L1 in the Mixer to a maximum reading on the electronic voltmeter which should indicate approximately 10 mV.
- (13) Transfer the electronic voltmeter to pin 4 on the 37.5 MHz Amplifier and adjust T1 on the amplifier for maximum indication. A level of approximately 100 mV should be obtained.
- (14) At the bracket on the underside of the receiver disconnect the lead which goes to the 37.5 MHz Generator module (Fig. 18). Connect the signal generator output to this lead and inject 37.5 MHz at an e. m. f. of 20 mV.
- (15) Connect the electronic voltmeter to pin 5 on the Harmonic Mixer board. Adjust RV1 on the Mixer board for a minimum reading on the electronic voltmeter.

## 1ST MIXER

### Test Equipment

20. Two Signal Generators 3.5 MHz and 43.5 MHz  
Electronic Voltmeter.

### Initial Control Setting

21. MHz Tuning - 03.

### Alignment Procedure

22. (1) Disconnect the two free coaxial leads which feed the 1st Mixer from their connections to the R. F. Module and 1st V. F. O. (1st V. F. O. connection is at a bracket on the underside of the receiver, see Fig. 18)
- (2) Connect signal generator No. 1 to PL1 on the 1st Mixer lead normally fed from the R. F. Unit. Set this generator to 3.5 MHz at a p.d. of 10 mV, measured at pin 2 on the 1st Mixer board.
- (3) Connect signal generator No. 2 to PL3 on the 1st Mixer lead which is normally fed from the 1st V. F. O. (underside of the receiver). Set this generator to 43.5 MHz at an e. m. f. of 200 mV.
- (4) Connect the electronic voltmeter to pin 6 on the 2nd Mixer board.
- (5) Set the System switch to MAN and check that the electronic voltmeter reads 10 mV  $\pm 3$  dB.

## FILTERS

23. No information is given on the alignment of the 40 MHz or the 37.5 MHz Bandpass Filters because it is considered that the equipment and specialized skill required for satisfactory alignment of these filters is outside the scope of the average service department. A factory aligned unit should be fitted in the unlikely event of a defect in either of these units.

## 2ND V.F.O.

### Test Equipment

24. Digital Frequency Meter (Counter)  
Electronic Voltmeter

### Procedure

NOTE: The 2nd VFO cover need not be removed.

25. (1) Refer to Chapter 3 page 3-6 and perform the KHz Tuning Calibration Check in paragraph 8. If the frequencies are not correct make fine adjustment of C4, accessible through a hole in the module cover.
- (2) Connect the electronic voltmeter to the '2nd VFO OUT' socket on the rear panel across a 75 ohm termination. A level of 50 mV should be obtained.
- (3) Transfer the electronic voltmeter to the test point TP2 in the 3rd Mixer module (Fig. 11). A level of not less than 50 mV should be obtained.

## 1ST V.F.O.

### Test Equipment

26. Digital Frequency Meter (Counter)  
Electronic Voltmeter

### Initial Control Settings

27. MHz Tuning - not set to '00'

### Procedure

28. (1) Refer to Chapter 3 and perform the MHz Tuning Calibration Check in paragraph 9.
- (2) The 1st V.F.O. output check is described in Chapter 5 page 5-4 operation (5).

## R. F. MODULE

### Test Equipment

29.        Electronic Voltmeter  
            Signal Generator (75 ohms source)  
            DC Voltmeter  
            Coil Trimmer Tool (supplied with the receiver)

### Initial Control Settings

30.        System Switch - MAN  
            MHz Tuning - not on 00 MHz  
            RF RANGE - Wideband (WB)  
            AE ATT - Minimum (MIN)  
            RF Gain Control - Maximum (fully clockwise)

### Antenna Filter Alignment

31.        The filter alignment is unlikely to need attention. The procedure is described in para. 36 for use if needed as part of a major overhaul.

### Aerial Attenuator (AE ATT) Check

Fig. 4 Fig. L-4

32.        (1)     Set the receiver controls according to para. 30 above.  
            (2)     Check that approximately -4 volts is present on the a. g. c. line. (measure at microswitch 1SA).  
            (3)     Disconnect the 1st Mixer lead from the outlet (SKT2) on the R. F. Module.  
            (4)     Connect the electronic voltmeter across the outlet SKT2.  
            (5)     Set the signal generator to 3.5 MHz and connect the output to the R. F. INPUT (Antenna) socket.  
            (6)     With the receiver AE ATT control set to MIN, adjust the signal generator output for a suitable dB reference on the electronic voltmeter. Note the signal generator and voltmeter levels.  
            (7)     Set the AE ATT control one step towards MAX.  
            (8)     Increase the signal generator output to restore the reference level established in (6).  
            (9)     Note the increase in signal generator output, which should be 10 dB  $\pm$  2 dB.  
            (10)    Repeat operations (6), (7) and (8). The increase in attenuation obtained at each setting of the AE ATT control should be as follows:

## R. F. Module (Continued)

<u>AE ATT Switch Setting</u>		<u>Change in Attenuation</u>	
5	MIN	0 dB	(Reference)
4		-10 dB	±2 dB
3		-20 dB	±2 dB
2		-30 dB	±2 dB
1	MAX	-40 dB	±2 dB

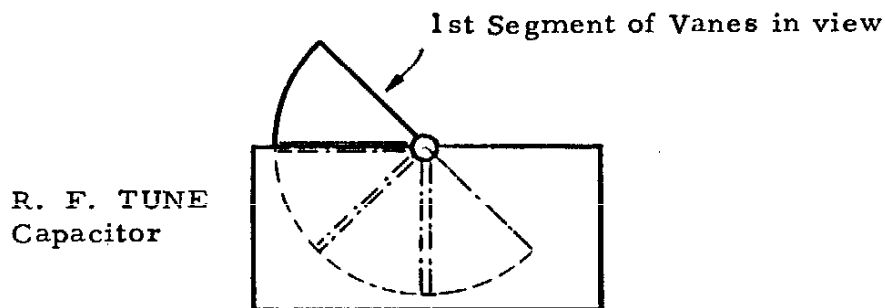
### Coil and Capacitor Assembly Alignment

NOTE 1: The cores of coils 2L1 to 2L5 and capacitors 2C1 to 2C5 can be adjusted via holes in the receiver rear panel. Remove the plate marked "R. F. INPUT" to obtain access.

NOTE 2: A special double-ended plastic trimming tool is supplied with the receiver for the adjustment of 2L1 to 2L5. Note that the longer and thinner end of the tool must be used for this adjustment.

- 33.
- (1) Remove the cover from the R. F. Module.
  - (2) Using the plastic trimming tool set all coil cores, 2L1 to 2L5, to the extreme ends of the coil formers.
  - (3) Set the trimmer capacitors 2C1 to 2C5 to the fully withdrawn position (minimum capacitance).
  - (4) Connect the signal generator (75Ω source) to the R. F. INPUT (Antenna) socket.
  - (5) Connect an electronic voltmeter to the R. F. Module output. (SKT2 on the side of the unit). Set the voltmeter initially to the 10 mV range.
  - (6) Set the R. F. TUNE control fully anti-clockwise and then turn clockwise about 45 degrees so that the knifing slot of the first segment of the vanes is aligned with the edge of the static vanes. (see illustration opposite) The dot on the R. F. TUNE control should coincide with the 1 MHz engraving on the scale.





- (7) Set the signal generator to a frequency of 1.0 MHz at an e. m. f. of 3 mV.
- (8) Set the receiver controls as follows:  
 System switch - MAN  
 R. F. RANGE - '1-2'  
 R. F. GAIN - maximum clockwise  
 AE ATT - MIN  
 MHz tuning - not on '00'.
- (9) Check that approximately -4 volts is present on the a. g. c. line.
- (10) Re-fit the cover to the R. F. Module.
- (11) Insert the trimming tool into the core aperture of 2L1. Engage the secondary core which is at the end nearer to the rear of the receiver. Check that the core is fully anti-clockwise, then screw the core slowly clockwise for a maximum indication on the electronic voltmeter. The core must be set to the first tuning point obtained. Adjust the voltmeter range as necessary.
- (12) Push the trimming tool right through to the further end to engage the primary core. Check that the core is fully clockwise, then slowly screw the core inwards (anti-clockwise) to obtain a maximum voltmeter reading at the first tuning point. The primary tuning is fairly insensitive and close attention is required to observe the resonant point.
- (13) Set the signal generator to 2.0 MHz.
- (14) Adjust the R. F. TUNE control for a maximum indication on the electronic voltmeter and adjust the trimmer capacitor 2C1 for a maximum voltmeter reading. Note this maximum reading as a reference.

- (15) Tune the signal generator as follows and note the output readings obtained.

(a) 1.8 MHz

(b) 2.2 MHz

The voltage ratio at resonance (operation 14) relative to the off-tune readings in (a) or (b) should be not less than 6 to 1.

- (16) Set the signal generator to 1.5 MHz.

- (17) Adjust the R. F. TUNE control for a maximum indication on the electronic voltmeter and note this reading as a reference. Check that the R. F. TUNE control cursor lies within the scale calibration marks.

- (18) Set the signal generator as follows and note the output readings obtained.

(a) 1.65 MHz

(b) 1.35 MHz

The voltage ratio at resonance (operation 17) relative to the off-tune readings in (a) and (b) should be not less than 6 to 1.

- (19) Set the signal generator to 1.0 MHz and repeat the procedure of (17).

- (20) Repeat the procedure of (18) at signal generator frequencies of 900 kHz and 1.1 MHz.

- (21) Align the remaining circuits, that is the 2-4 MHz, 4-8 MHz, 8-16 MHz and 16-30 MHz ranges, as described in operations (6) to (20) but using the frequencies specified in the following alignment table. Set the R. F. RANGE control as stated in the left hand column. The right hand column is available for the tester to insert the readings obtained. The voltage ratio of the resonance reading relative to the 'off-tune' readings must in all cases be not less than 6:1

Refer to the alignment table on the next page

ALIGNMENT TABLE  
Coil and Capacitor Assembly

<u>R. F. Range Setting</u>	<u>Signal Generator Setting</u>	<u>Adjust</u>	<u>Output Readings Obtained</u>
2 - 4 MHz	2.0 MHz	2L2	
"	4.0 MHz	2C2	
"	3.6 MHz and 4.4 MHz		
"	3.0 MHz		
"	2.7 MHz and 3.3 MHz		
"	2.0 MHz		
"	1.8 MHz and 2.2 MHz		
4 - 8 MHz	4.0 MHz	2L3	
"	8.0 MHz	2C3	
"	7.2 MHz and 8.8 MHz		
"	6.0 MHz		
"	5.4 MHz and 6.6 MHz		
"	4.0 MHz		
"	3.6 MHz and 4.4 MHz		
8 - 16 MHz	8.0 MHz	2L4	
"	16.0 MHz	2C4	
"	14.4 MHz and 17.6 MHz		
"	12.0 MHz		
"	10.8 MHz and 13.2 MHz		
"	8.0 MHz		
"	7.2 MHz and 8.8 MHz		
16 - 30 MHz	16.0 MHz	2L5	
"	30.0 MHz	2C5	
"	27.0 MHz and 33.0 MHz		
"	24.0 MHz		
"	21.6 MHz and 26.4 MHz		
"	16.0 MHz		
"	14.4 MHz and 17.6 MHz		

R. F. Amplifier Alignment

34. (1) Refer to paragraph 32 and set up the receiver and test equipment according to operations (1) to (4). The signal generator level should be set to 3 mV.
- (2) Sweep the signal generator across the 1 to 30 MHz passband, note the electronic voltmeter readings and check that the response does not vary by more than 6 dB. If necessary adjust coils 3L1, 3L2, 3L3 and 3L4 on the amplifier board for minimum undulation in the passband.

### R. F. Amplifier A. G. C. Adjustment

- 35.
- (1) The signal generator and electronic voltmeter should be connected as in paragraph 32. Set the signal generator to 5.5 MHz, c.w., 10 mV e.m.f.
  - (2) Check that the System switch is at A.G.C. Med.
  - (3) Connect a d.c. voltmeter -ve lead to the collector of 3VT1 (Fig. L-4).
  - (4) Adjust potentiometer 4RV1 (which is on the Filter component board mounted on the underside of the receiver) until the collector voltage of 3VT1 just 'bottoms'. A reference to the electronic voltmeter reading should show that the bottoming point of 3VT1 coincides with maximum r.f. gain. Refer to Chapter 1 paragraph 34 for a description of the procedure.
  - (5) Disconnect the signal generator and electronic voltmeter. Reconnect the 1st Mixer lead to the R. F. Module.

### Antenna (0-30) MHz Filter Alignment

NOTE: This alignment should not normally be required and should be considered only as part of a major overhaul.

- 36.
- (1) Connect the electronic voltmeter to the output lead of the 0-30 MHz filter.
  - (2) Connect the signal generator (75 $\Omega$  source) to the R. F. INPUT (Antenna) socket. Set the generator to 40 MHz and an e.m.f. of 1 volt.
  - (3) Adjust the coil 1L1 for a minimum reading on the electronic voltmeter.
  - (4) Set the signal generator to 56 MHz and adjust coil 1L2 for a minimum reading on the electronic voltmeter.
  - (5) Set the signal generator to 43 MHz and adjust coil 1L3 for a minimum reading on the electronic voltmeter.
  - (6) Sweep the signal generator frequency from 1 to 30 MHz. Observe the electronic voltmeter readings and check that the response does not vary by more than 1 $\frac{1}{2}$  dB.
  - (7) Remove the test equipment.

## CHAPTER 5

### FAULT LOCATION

#### INTRODUCTION

1. This chapter provides fault location advice at two levels. Paragraphs 2 to 11 assume that the only test equipment available is a universal test meter (Multimeter). The object being to locate an elementary fault. Paragraphs 12 to 16 assume the use of additional test equipment, and will direct the user to the appropriate paragraphs in Chapter 4 (Alignment).

#### PRELIMINARY CHECKS

2. If the receiver is newly installed check the following items:
  - (a) AC/DC selector switch correctly set. (rear panel).
  - (b) 2nd V. F. O. switch set to INT (front panel).
  - (c) MHz tuning control not set to '00'.
  - (d) Power connection: Note that the polarity of a d. c. supply must be correct. (Refer to Chapter 2).
  - (e) Antenna connected.

#### INITIAL FAULT LOCATION PROCEDURE

##### Controls

3. Set the receiver as follows and check for signal or noise.
  - (1) System switch to MAN.
  - (2) DET - B. F. O. switch to A. M.
  - (3) Meter switch to R. F.
  - (4) A. F. GAIN to maximum (clockwise).
  - (5) R. F. GAIN to maximum (clockwise)

- (6) I. F. BW Switch to 3 kHz
- (7) AE ATT control to the MINIMUM position (MIN)
- (8) R. F. RANGE switch to "WB"
- (9) Ensure that the MHz tuning control is not set to '00'.

#### Basic Diagnosis

4. The most useful indication in elementary fault diagnosis is receiver noise, or 'mush'. The controls should be set as listed in paragraph 3 and the receiver tuned over a suitable portion of the h. f. band. At each step of the MHz tuning control make a fine adjustment and listen for a rise in receiver noise level. If no noise can be heard, check that the phones are serviceable and, if possible, listen at an alternative audio outlet as well as at the phones jack socket. Note the receiver meter reading. If a reading is obtained, reduce the R. F. GAIN and the meter should deflect to the right. This indicates that the h. t. supply and a. g. c. line are normal.

#### POWER CHECK

5. If the receiver appears dead (no noise or meter reading) and the dial lights are not illuminated, check the H. T. fuse and then measure the -16 volts h. t. at one of the following points:
- (a) On the terminal block TB3 at the pin adjacent to the Fine Tune potentiometer (Fig. 18).
  - (b) At the centre tag of the 2nd V. F. O. EXT/INT switch.
  - (c) At the microswitch 1 SB. The centre tag is the h. t. feed to the receiver front end. The reading should be present in all settings of the MHz control except '00'. When '00' is selected the reading appears on the top tag. It should be present on the bottom tag in all modes of operation.
  - (d) The rear panel terminal H. T. R. F. should give a -16 volt reading except when the MHz control is set to '00'.

## GENERAL CHECK

6. (1) Set the receiver controls according to paragraph 3.
- (2) Set the System switch to CHECK B. F. O. and rotate the DET - B. F. O. MODE switch through all settings. Select +6 to -6 and rotate the B. F. O. variable control. Listen for the b. f. o. heterodyne whistle and observe the receiver meter indications. These indications can be used for diagnosis as indicated in the following Table.

TABLE 1

### "CHECK B. F. O. " INDICATIONS

<u>Meter Indication Observed</u>	<u>B. F. O. Whistle Audible</u>	<u>Diagnosis</u>
(a) Yes	Yes	Receiver is serviceable from 3rd Mixer input through to audio output. Also 1 MHz is functioning.
(b) Yes	No	Fault probably in detector board of I. F. Module (Fig. 12) or audio amplifier board or connections. (Fig. 14).
(c) No	No	Possible areas of fault are:-  (a) 1 MHz reference (Fig. 6)  (b) 1st i. f. amplifier unit (Fig. 11)  (c) Main i. f. amplifier board of I. F. Module (Fig. 12).  (d) Transistor stage VT3 in 3rd Mixer (Fig. 11).

7. If both whistle and meter reading are obtained in CHECK B. F. O. set the System switch to CAL. If no calibration whistles are obtained as the kHz tuning is rotated, it suggests a fault in the 2nd V. F. O. or the mixer stage of the 3rd Mixer.

8. If the CHECK B. F. O. and CAL tests are satisfactory, set the controls as listed in paragraph 3 and make a front end check as follows:-

#### FRONT END CHECK

9. Set the DET - B. F. O. switch to A. M. Listen intently and slowly rotate the MHz tuning control. If a very slight rise in noise level can be heard as the MHz tuning passes through each resonant point it suggests that the 37.5 MHz loop is functioning and therefore the fault is more likely to be in the antenna circuit, R. F. Module or 1st Mixer. Make the check in the WB setting of the R. F. RANGE switch as well as in the tuned antenna condition (adjust R. F. TUNE control). Thoroughly check all front end connections as follows:

- (1) Check Antenna
- (2) Check continuity through the 500 mA fuselink in the R. F. Module.
- (3) Ensure that the muting relay is not energized. Touching an earth to pin G of the 12-way socket on the rear panel should cause the relay to operate. At the same time listen for any change of noise level.
- (4) Check the connections between the R. F. Module and 1st Mixer (on the side of the R. F. Module).

10. If, when tuning the MHz control as described in the previous paragraph, no noise can be heard, the 1st V. F. O. or its connections may be faulty. Check connections from 1st V. F. O. to 1st Mixer and 37.5 MHz Generator respectively at the bracket on the underside of the main chassis. Ensure that they are not reversed.

#### R. F. H. T. Check

11. On the terminal block TBI at the rear of the receiver connect the terminal H. T. R. F. to the terminal H. T. L. F. If the receiver then functions correctly the microswitch LSB (Fig. 16, Fig. 18) should be checked. Make a voltage check at the microswitch (centre tag).

#### 1 MHz Check

12. Set the System switch to CAL and tune the KHz control to the 100 kHz calibration check frequencies. If the calibration whistle is heard at each point it indicates that the 1 MHz reference is functioning. If no calibration whistles are heard, turn the System switch to CHECK B. F. O. and set the DET - B. F. O. switch to +6, +3, -3 and -6 kHz in turn. If, again,



no heterodyne whistles are heard, it indicates a faulty 1 MHz crystal oscillator. Check that the crystal is correctly fitted in the upper deck of the 37.5 MHz Generator Module. If test equipment is available check with an electronic voltmeter for an e. m. f. of 100 mV at the rear panel socket "1 MHz OUT".

#### A. G. C. FAULT

13. If the receiver operates satisfactorily with manual r. f. gain control (System switch to MAN) but overloads on strong signals in the a. g. c. settings of the System Switch check as follows:

- (1) Tune the receiver to a strong signal. Set the System switch to A. G. C. Med and the Meter switch to R. F. If the meter indicates a reading appreciable greater than 1 microvolt the a. g. c. board in the I. F. Module is serviceable. If no reading is obtained the fault is probably in the I. F. Module.
- (2) If the meter reading is satisfactory, connect the test meter negative lead to the terminal A. G. C. R. F. on the rear panel (positive lead to chassis). As the receiver is tuned through a powerful signal the a. g. c. level should change from -4V (no signal) to approximately 0 volts (strong signal). If no reading is obtained check the microswitch 15A adjacent to the MHz tuning shaft. (Fig. 16 Fig. 18). The bottom tag of the microswitch should show the a. g. c. level in all operating modes; the centre tag in all settings of the MHz control except '00' and the top tag only in the '00' setting of the MHz tuning control.

NOTE: The levels quoted in para. 13 cannot be given exactly because the level of a strong signal is not defined.

#### DETAILED CHECK

14. (1) Connect a signal generator, 75 ohm source to the antenna socket and set to 3.6 MHz at 10 mV p. d. (20 mV e. m. f.)
- (2) Disconnect the coaxial lead from the front end of the I. F. Module. Terminate the free lead in 100 ohms.
- (3) Connect the electronic voltmeter across the 100 ohm termination.
- (4) Set R. F. RANGE to WB  
AE ATT to MIN  
System Switch to MAN  
R. F. GAIN fully clockwise.

- (5) Carefully tune the MHz and kHz tuning controls to 03.500  
At the resonant point the electronic voltmeter reading  
should rise to 100 mV approx. If no reading, or very low  
reading is obtained proceed as described in next paragraph.

Fault Prior to I. F. Unit

15. (1) Refer to para. 12 and check that 1 MHz oscillator is  
functioning. If no whistles are heard check the 1 MHz  
module as described in Chapter 4 para. 18.
- (2) Move the 2nd V. F. O. switch between the INT and EXT  
positions and listen for a change of noise level. If noise  
level does not change, the 3rd Mixer may be faulty.  
Make sure that the 2nd V. F. O. switch is returned to the  
INT position. Refer to Chapter 4 for further tests.
- (3) If the 3rd Mixer check is satisfactory, but a fine adjust-  
ment of the MHz tuning control fails to produce any rise  
in noise level, proceed as follows:
- (4) On the 2nd Mixer connect an electronic voltmeter to test  
point TP2. Rotate the MHz tuning control slowly, and  
note the voltmeter reading as a frequency is selected.  
The reading should rise to approximately 80 mV at each  
resonant point.
- (5) If approximately 80 mV is not obtained in (4) check the  
1st V. F. O. outputs. Disconnect the free coaxial leads  
from their respective bulkhead sockets on the (underside  
of the main chassis. (Fig. 18). Terminate the lead  
which feeds the 1st Mixer in  $47\Omega$  and check for approx.  
100 mV with the electronic voltmeter. Terminate the  
lead which feeds the 37.5 MHz Generator in  $27\Omega$ , and  
check for approx. 100 mV with the electronic voltmeter.
- (6) If the 1st V. F. O. outputs are satisfactory the 37.5 MHz  
Generator module must be checked in accordance with  
Chapter 4 paragraph 19.
- (7) If the 37.5 MHz checks are satisfactory check the R. F.  
Module as follows:

- (8) Disconnect the r.f. output lead from the side of the module (SKT2) and connect an electronic Voltmeter to the socket.
- (9) Connect a signal generator (75 $\Omega$  source) to the R.F. INPUT (antenna) socket. Set the signal generator to the levels indicated in Table 2, according to whether the receiver is in the R.F. TUNE or the WB mode, and check the electronic voltmeter readings. The System switch should be at MAN, AE ATT to MIN and RF GAIN to maximum.

TABLE 2

Signal Generator Level (e.m.f.)	<u>Output from R.F. Module</u>	
	In Tuned Mode	In WB Mode
3 mV	18 mV	-
10 mV	-	10 mV

- (10) A low output from the R.F. Module may indicate an a.g.c. fault. With the System switch to MAN, and the R.F. GAIN to maximum, the d.c. reading on the a.g.c. line should be -4 volts. A suitable measuring point is at the rear panel terminal 'a.g.c., r.f.', or if the cover is removed at the centre contact of the microswitch 1SA (Fig.18). If this a.g.c. level is not obtained a fault in the i.f. unit is probable. If the -4V level is satisfactory the r.f. amplifier gain may be tested with the a.g.c. removed, as follows:-
- (11) On the r.f. amplifier board connect two 0.1  $\mu$ F capacitors between the -16V line and the junction of diodes 3D1 and 3D2, and 3D3 and 3D4, respectively, thereby removing the gain control from 3VT2 and 3VT3. Note the resulting increase in output. If the increase in gain is significantly greater than 4 dB the a.g.c. circuit should be investigated. The forward resistance of the diodes 3D1 to 3D4 and 3D7 to 3D10 should be checked. When measured on the 'ohms x 100' range of the AVO8 testmeter the forward resistance of any one of the diodes should not exceed 45 $\Omega$ .

#### Fault in the I.F. Unit

16. A systematic check on the I.F. Unit is described in Chapter 4.

## CHAPTER 6

### ROUTINE MAINTENANCE

#### GENERAL

1. The RA.1217 receiver should require no mechanical maintenance until a considerable period of service has elapsed, provided that the receiver has been treated with reasonable care. It is important that modules should be carefully but firmly replaced following removal and that all covers should be clean and secure, to maintain the high standard of screening which is necessary. Make sure that no cover-screws have suffered stripped threads due to overtightening. Whenever a module has been removed ensure that on replacement it is clean and free from grease or corrosion to ensure good electrical bonding. Ensure that retaining screws are made tight.

#### LUBRICATION

2. No lubrication is needed for at least the first year of service.  
Fast moving shafts are carried in sealed races which require no lubrication. Certain slow moving surfaces are carried in 'oilite' bearings which after appreciable service may each be given a single drop of thin molybdenised oil at intervals of approximately six months. A drop or two of oil may be given to the stop-collars of the MHz and KHz tuning system. Remove any surplus lubricant to prevent the accumulation of dirt.

## CHAPTER 7

### DISMANTLING AND RE-ASSEMBLY

**WARNING:** BEFORE DISMANTLING ANY PART OF THE RECEIVER  
DISCONNECT THE MAIN POWER SUPPLY AT ITS SOURCE.

#### INTRODUCTION

1. This chapter describes how to remove the modular units of the receiver. Detailed re-assembly instructions are not given in those cases where it is feasible to interpret the dismantling procedures in the reverse order. Detailed instructions are given however, for re-assembly of the R. F. Unit, 1st V. F. O. and 2nd V. F. O. due to the requirement for accurate setting of variable controls in these modules. Reference to figure 18 will assist identification of the required module.

- CAUTION:** (1) When refitting a module which requires the mating of a fixed plug and socket. Take care that the plug and socket are correctly aligned before applying pressure to the module. Otherwise pin damage may result.
- (2) It is important that all module retaining screws should be firmly tightened to ensure good electrical bonding throughout the receiver. Loose screws can cause spurious frequencies to develop. When tightening screws, do not apply such force that screw threads might become stripped.

#### RECEIVER TOP COVER

2. The top cover of the rack mounted receiver is retained by 15 screws. Note the securing screw near to the centre which locates in the 1 MHz unit. All the cover screws must be tight during normal operation to ensure satisfactory screening. This cover must be removed as a first step in any dismantling operation except for removal of the power unit.

#### UNDERSIDE SCREWS

3. Those screws on the underside of the receiver which secure the various modules are marked with a circle of paint.

#### RECEIVER BOTTOM COVER

4. A small cover on the underside of the receiver is held by 8 screws. This cover may be removed for access to the audio board, the H. T. Filter board and the connectors of the 2nd and 3rd Mixer modules.

## FRONT PANEL

5. The removal of the panel is normally of no benefit in servicing, but it is necessary if the B. F. O. assembly is to be removed.
6. Tools: Hexagonal keys  
Screwdriver  
Spanner.

### Front Panel Removal

7. (1) Using a suitable hexagonal key slacken the grub-screws and remove all control knobs.  
(2) The panel is held by four chromium plated screws. Remove these nuts and screws.  
(3) Remove the two chromium screws in the centre of the panel adjacent to the meter.  
(4) The panel can now be withdrawn.

## POWER UNIT

### 8. Removal

- (1) Release the four captive retaining screws from the unit on the rear panel and ease the unit gently towards the rear.

### 9. Re-assembly

- (1) Insert the unit squarely and apply gentle pressure, evenly, to ensure correct mating of the plug and socket, and replace the four retaining screws.

## I. F. MODULE

10. Tools: Medium and large screw drivers:  
Spanner .25 inch A. F.

### 11. Removal

- (1) Remove the chassis side plate (6 screws).
- (2) Using the spanner; undo the external coaxial connector from the socket at the forward end of the module.
- (3) Remove two screws from the underside.
- (4) Remove two screws from the right-hand side (viewed from the rear) of the rear connector panel.
- (5) Withdraw the module towards the rear, releasing the 37-way connector at the front end while doing so.

## R. F. MODULE

12.           Tools: Hexagonal Key  
              Screwdrivers  
              Spanner .25 inch A. F.

### 13.           Removal

- (1)       Remove the chassis side plate (6 screws)
- (2)       At the rear of the front panel release the grub screws in the boss of the R. F. Range calibrated scale.
- (3)       Slacken the grub screws in the control knob and remove.
- (4)       Within the receiver behind the front panel, on the side, remove the two screws which hold the shaft bearing bracket.
- (5)       Slacken the grub screws in the control shaft flexible coupler. Pull the control shaft forward a short distance out of the coupler.
- (6)       Release the five retaining screws on the underside of the chassis.
- (7)       Remove the coaxial connector from the side of the module adjacent to the 1st Mixer.
- (8)       Release the connector plug from the forward end. Earlier modules have soldered connections on the side; these must be unsoldered after noting the pins and colour coding of the wiring.
- (9)       Draw the module forward a short distance and then lift upwards.

### R. F. Module Refitting

14.           (1)       Remove the cover from the R. F. Module.
- (2)       Place the module approximately into its position in the chassis and solder the connections to the pins on the side. (In latter versions of the module these soldered connections are not fitted, connections are made by a plug and socket at the front end).
- (3)       Connect the coaxial lead from the 1st Mixer to the socket on the side of the R. F. Module.
- (4)       Place the module in position and screw-up the five retaining screws on the receiver underside.

- (5) Insert the connector plug at the forward end (only on later versions of the module).
- (6) Turn the Range switch shaft by hand to its fully anti-clockwise setting (viewed from the front).
- (7) Insert the control shaft into the coupler. (Ensure that the R. F. Range calibrated scale is mounted on the shaft).
- (8) Tighten the grub screws in the shaft coupler.
- (9) Set the R. F. Range scale so that 'WB' is displayed in the window and then tighten the grub screws in the boss of the Range scale.
- (10) Put the R. F. Range control knob on to the shaft and tighten the grub screws. Rotate the control and check that the Range figures are correctly positioned in the window.
- (11) In the R. F. Module set the variable capacitor so that one segment of vanes is clear (see illustration in Chapter 4).
- (12) Put the knob on the control shaft so that the white spot is in line with the panel markings 1 to 16 and tighten the grub screws.
- (13) Replace the module cover and chassis side plate.

### 37.5 MHz GENERATOR

### 1 MHz OSCILLATOR AND CALIBRATOR

15. These two units are contained in separate sections mounted in a single module. Following removal of the module the two units can be separated, if necessary, but this involves delicate work with a low-wattage soldering iron.

Tools: Screwdrivers.

### 16. Removal

- (1) On the underside remove the cover plate and disconnect the 37.5 MHz Generator coaxial lead from the connector bracket (Fig. 18).
- (2) Release the four screws on the underside of the receiver.
- (3) Unplug the multi-way connector from the module.
- (4) Lift out the module.

### 17. Sub-Unit Separation

- (1) The upper deck is the 1 MHz and calibrator unit, the lower unit contains the harmonic generator, harmonic mixer and 37.5 MHz circuit.



- (2) Remove the cover from the upper unit (three screws).
- (3) Release the four captive screws in the base of the upper unit. The upper unit can now be hinged upwards.
- (4) Remove the cover from the lower unit to obtain access for adjustment and servicing.
- (5) To completely remove a unit it is first necessary to unsolder two wires from the lower unit, using a low-wattage soldering iron, as follows:
- (6) Unsolder the violet-coloured wire from the base of the lower unit.
- (7) The blue coaxial lead can be unsoldered from the underside of the small transverse board on the lower unit. Undo the screws holding the board and lift upwards to give access to the unsoldering point. Use the minimum heat necessary to free the joint.

#### 1st MIXER and 40 MHz FILTER

18. Tools: Screwdriver  
Spanner .25 inch AF

#### 19. Removal

- (1) Disconnect the coaxial lead from the side of the R. F. Module.
- (2) On the receiver underside remove the cover plate and disconnect the 1st Mixer lead from the connector bracket.
- (3) On the underside, adjacent to the H. T. Filter Board release the screw which is located in a tubular shroud. (The one further from the rear panel).
- (4) On the upperside release one screw at each end of the 1st Mixer and 40 MHz unit.
- (5) Pull the unit upwards taking care not to trap the free coaxial leads which are attached.

#### 2nd MIXER

20. Tools: Screwdriver

#### 21. Removal

- (1) Remove the cover plate from the underside of the receiver.
- (2) On the underside remove two of the four retaining screws. (from diagonally opposite corners).

- (3) Slacken off the two remaining screws and push them upwards, thereby partly easing the module out of its connector. Then completely remove these screws.
- (4) On the upperside grip the module and pull upwards. If sufficient grip cannot be obtained, remove the module cover and carefully pull on the pillars.

### 3rd MIXER

22. Follow the same procedure as for the 2nd Mixer in the previous paragraphs.

### 37.5 MHz BANDPASS FILTER

23. Tools: Screwdriver.

24. Removal

- (1) On the receiver underside remove the cover plate and release the retaining screw which is located in a tubular shroud adjacent to the H. T. Filter board. (The screw nearer the rear of the receiver).
- (2) On the upper chassis release the two end screws from the 37.5 MHz Filter Unit.
- (3) Ease the unit upwards, keeping it level to avoid distortion of the fixed coaxial connectors.

### 1st V. F. O.

25. Tools: Screwdriver  
Hexagon key  
Spanner .25 AF  
Soldering iron (earlier receivers only)

NOTE: Instructions for refitting are given in paragraph 27.

26. Removal

- (1) Disconnect the violet h. t. lead from the small terminal block adjacent to the 1st V. F. O. If this terminal block is not fitted refer to operation (2).
- (2) On earlier receivers it is necessary to unsolder the violet h. t. lead from the H. T. Filter board on the underside of the receiver. (Remove the cover plate).
- (3) Slacken the grub-screws in the coupler on the 1st v. f. o. tuning shaft.
- (4) On the receiver underside remove the cover plate and disconnect the two 1st v. f. o. coaxial leads from the connector bracket.

- (5) Hold the 1st v.f.o. firmly in position with one hand. With the other release the four retaining screws on the underside of the receiver.
- (6) When the retaining screws are free the 1st v.f.o. can be drawn free of the shaft coupler and lifted out.

#### 1st V.F.O. Refitting

NOTE: It is assumed that all other parts of the receiver are installed and are serviceable. A digital counter to read up to 70 MHz is required.

27. (1) Place the 1st v.f.o. module into its correct position on the chassis and slide the tuning shaft into the shaft coupler. Do not tighten the grub screws. Check that the coaxial leads are fed through to the underside of the receiver.
- (2) Hold the 1st v.f.o. module with one hand and make it secure with the four retaining screws on the underside.
- (3) Connect up the h.t. lead at terminal block TB2 (or resolder the violet lead if this was disconnected in operation (2)).
- (4) Attach a digital counter to one of the 1st v.f.o. coaxial output leads.
- (5) Set the MHz control to '01'
- (6) Connect power to the receiver and set the System switch to MAN.
- (7) Move the 1st v.f.o. section of the tuning shaft by hand (not the MHz control) until the digital counter reads 41.5 MHz  $\pm 10$  kHz.
- (8) Check that the MHz control is at '01' and tighten the grub-screws in the shaft coupler. On completion the digital counter must read 41.5 MHz  $\pm 20$  kHz.
- (9) Refer to Chapter 3 paragraph 9 and perform the MHz calibration check.
- (10) On completion connect both the 1st v.f.o. output coaxial leads to their correct sockets at the bracket on the underside of the receiver.

#### 2nd V.F.O.

28. Tools: Spanner 10/32 U.N.F. Hex  
Hexagonal key

NOTE: Instructions for refitting are given in paragraph 30.

29.

#### Removal

- (1) Using the hexagonal key slacken the grub screws in the shaft coupling.
- (2) Detach the connector which carries the chassis wiring.
- (3) Completely remove the three bolts which hold the module to the cast lugs of the chassis.
- (4) Draw the module away so that the tuning shaft slips out of the shaft coupler.

#### 2nd V. F. O. Refitting

NOTE: A digital frequency meter (counter) is required.

30.

- (1) Rotate the kHz tuning control fully anti-clockwise against its stop, then turn clockwise and set the readout to indicate '000'. This ensures that the correct end of the scale is selected.
- (2) Lock the kHz control at .000.
- (3) Set the CAL-FINE TUNE control to the mid-point of its rotation.
- (4) Remove the cover from the 2nd V. F. O. module and set the capacitor vanes by hand to the minimum capacitance position (moving vanes fully out of mesh and straight edges parallel).
- (5) Place the 2nd V. F. O. module into position on the chassis and enter the shaft into the flexible coupler on the control mechanism.
- (6) Make the module secure by inserting the three retaining bolts and tightening up.
- (7) Insert the connector plug into the module socket.
- (8) Connect the digital counter to the rear socket '2nd V. F. O. OUT'. Check that the 2nd V. F. O. switch is at INT.
- (9) Connect the power supply to the receiver and set the System switch to MAN.
- (10) By hand make a fine adjustment of the capacitor shaft to obtain a reading on the digital counter of 4.6 MHz plus or minus 50 Hz.
- (11) Tighten one grub screw in the shaft coupler and ensure that the counter reading has not changed while tightening.
- (12) Put the cover on the module and make tight the screws.

- (13) Set the System switch to CAL.
- (14) Refer to Chapter 3 paragraph 8 and perform the 2nd V. F. O. calibration check.
- (15) If results are satisfactory tighten both grub screws in the shaft coupler and check that the module cover is firmly screwed down. If the calibration check is outside the limits of  $\pm 500$  Hz refer to (16) below.
- (16) The trimmer capacitor C2, which is accessible via a hole in the cover of the 2nd V. F. O. module (the upper of the two holes) may be adjusted to correct a calibration error of up to one kilohertz. Before making any adjustment of C2 ensure that the hand-setting of the capacitor vanes in operation (10) has been done as accurately as possible.

#### 1st I. F. UNIT

31. This small unit is part of a large assembly which includes the i.f. bandwidth filters together with the Bandwidth switch and B. F. O. controls.

32. Tools: Screwdriver  
Spanner .25 inch AF  
Soldering iron

#### 33. Removal of 1st I. F. Unit

- (1) Remove the main I. F. Module (Refer to paragraph 11) and unplug the 2nd Mixer module.
- (2) On the underside of the receiver remove the five screws which retain the bandpass filter assembly.
- (3) On the upper side remove the two screws which secure the 1st I. F. Unit to the Bandpass filter assembly.
- (4) Move the bandpass filter assembly sideways. This gives access for the unsoldering of the wires from the 1st I. F. Unit. Ensure that the coaxial leads to the  $1000\Omega$  and  $100\Omega$  output pins are identified for correct re-connection.
- (5) Push the 1st I. F. Unit out of its mounting and lift out.

NOTE: The coaxial connection to the 3rd mixer (wire number 8) may have to be unsoldered if it restricts the movement of the filter assembly.

#### B. F. O. Assembly

34. The B. F. O. oscillator and amplifier boards are part of a larger assembly including the B. F. O. controls, Bandwidth switch, i. f. bandpass filters and 1st I. F. Unit. The removal of this entire assembly

involves the unsoldering of a complex cable harness and should not normally be necessary. To remove the B. F. O. boards proceed as follows.

35.           Tools: Screwdriver  
              Soldering iron  
              Spanner .25 inch AF

36.           Removal of B. F. O. Boards

- (1)       Remove the main I. F. Module (Refer to paragraph 11).
- (2)       On the underside of the receiver remove the five screws which retain the bandpass filter assembly.
- (3)       Move the filter assembly sideways and unsolder all connections from the 1st I. F. Unit and the crystal filters.
- (4)       Lift out the bandpass filter assembly.
- (5)       The B. F. O. boards are now accessible. Unsolder the connections from the board to be removed. Remove the four retaining screws and lift out the board.

METER CONTROL BOARD

37.           Tools: Screwdriver  
              Spanner 4BA  
              Soldering iron.

Removal

- (1)       Remove the side plate from the receiver (Six screws)
- (2)       Remove the four screws which secure the pillars of the control board to the side member of the receiver.
- (3)       Unsolder the connecting wires and lift out the board.
- (4)       When re-connecting identify the leads as follows. Also refer to Fig. 18.

R1	Wire 34	} Twin screened	D1/D2	Red/Blue
D2/D4	Wire 34		D3/D4	Blue/Orange
R2	Violet		R3	Blue/White

H. T. FILTER BOARD

38.           Tools: Soldering iron  
              4BA Spanner  
              Screwdriver

39.           Removal

- (1)       Remove the small cover from the underside of the receiver
- (2)       Unsolder the connecting wires from the H. T. Filter board.

- (3) Remove the two nuts and lift up the board sufficiently to unsolder the remaining connections.
- (4) Lift out the board.

#### AUDIO AMPLIFIER BOARD

40. Tools: Soldering iron  
Screwdriver

##### Removal of One-Watt Audio Board

- (1) Remove the small cover from the underside of the receiver.
- (2) Unsolder the connecting leads from pins 2, 3, 4, 5, 6, 7, 8, 9, of the audio board.
- (3) Remove the four retaining screws.
- (4) Carefully ease the transistors VT4 and VT5 out of their holders at the same time as the board is lifted out.
- (5) When re-assembling identify the connecting wires as follows:

Pin 2: To audio transformer (Red/Orange)	Pin 6: Violet (Red sleeve) Violet (White sleeve)
Pin 3: To capacitor 1C15	Pin 7: Sleeve 32
Pin 4: Sleeve 31	Pin 8: Earth, (Black)
Pin 5: To capacitor 1C12 (Red/White)	Pin 9: To capacitor 1C17.

#### 41. 10 mW Audio Board Connections

- Pin 1. Sleeved lead number 31 to slider of A. F. Gain potentiometer.
- Pin 2 { Orange/grey wire to 1SKT 11 pin A.  
Red wire of sleeve number 34 to meter diodes 3D2/3D4 (Fig.16).
- Pin 3 { Orange/brown lead to 1SKT 11 pin B.  
Blue lead of sleeve number 34 to resistor 3R1 (Fig.16).
- Pin 4 To screen of lead number 33.
- Pin 5 { Wire of lead number 33 to Phones jack JK1.  
Wire of screened lead (or orange/white on some receivers) to 1SKT 11 pin D.
- Pin 6 Violet (two leads) - 16V.
- Pin 7 Wire of lead number 32 to slider of A. F. Level potentiometer.
- Pin 8 Earthing wire to chassis tag.

42. B. F. O. and Bandwidth Assembly

The following items are mounted on an assembly which can be removed as a single unit, but such removal should not normally be attempted due to the numerous connections which have to be unsoldered.

- (a) B. F. O. oscillator and amplifier boards.
- (b) 1st I. F. Amplifier unit.
- (c) DET - B. F. O. Mode Switch.
- (d) Bandwidth (I. F. BW) switch.
- (e) R. F. Gain potentiometer.
- (f) A. F. Gain potentiometer.
- (g) Crystal bandwidth filters.

Tools: Screwdrivers  
Soldering Iron

Assembly Removal

- (1) Remove all the control knobs from the front panel.
- (2) Remove the four chromium screws from the front panel and remove the panel.
- (3) Remove the main I. F. Module.
- (4) On the underside of the receiver remove the five screws which secure the B. F. O. and Bandwidth Assembly.
- (5) At the front, above the B. F. O. controls, remove two screws. The assembly is now free to move, subject to the wiring connections which must be unsoldered.